Alberta Heavy Oil, Oil Sands and Enhanced Recovery

Experimental Pilot Projects
February, 1990

Alberta
OIL SANDS TECHNOLOGY
AND RESEARCH AUTHORITY

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Experimental Pilot Projects
February, 1990

A Survey Compiled by:

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Summary

The 1990 survey provides detailed coverage of all of Alberta's sixty-five active or recently suspended in situ heavy oil, oil sands and enhanced oil recovery pilot projects. Twelve of the sixty-five are recent or new experimental horizontal drilling projects. Each pilot project listed contains the following information:

- a detailed reservoir description
- a detailed field facilities description
- well pattern
- project-specific description of EOR process employed
- historical documentation of the engineering events associated with the project
- description of important adjustments made to improve the process performance.

AOSTRA participates in 19 of the projects and operates the Underground Test Facility.

Also enclosed is an AOSTRA Advanced Oil Recovery Technologies Wallchart.

Acknowledgements

AOSTRA gratefully acknowledges the cooperation of all the operators who provided the information contained in this survey. Once again, we have been able to secure 100% participation.

If you have any comments on how the survey can be improved, please contact AOSTRA/Calgary at (403) 297-3380.

PILOT PROJECTS IN ALBERTA

February, 1990

Operator	Sector
Alberta Energy Company Ltd.	Ipiatik Lake Phase A Ipiatik Lake Phase B (New) Suffield I* Suffield II* Suffield Horizontal Suffield Horizontal Well #2 (New) Suffield Hot Water Flood*
Alberta Oil Sands Technology and Research Authority	Athabasca*
Amoco Canada Petroleum Company Ltd.	Atlee Buffalo Brintnell Cessford* David Drumheller Horizontal Well (New) Gregoire Lake* Morgan Soars Lake (Beaverdam) New Project Soars Lake (Beaverdam)
Bow Valley Industries Ltd.	Marie (Cold Lake)*
BP Canada Inc. (Petro-Canada 50%)	Chauvin South Sparky 'E' Marguerite Lake* Project Owl
Bumper Development Corporation Ltd.	Twining Rundle 'A' Pool*
Canadian Hunter Exploration Ltd.	Swan Hills Beaverhill Lake*
Canada Northwest Energy Ltd.	Atlee Buffalo
Canadian Occidental Petroleum Ltd.	Manatokan Morgan
CS Resources Ltd.	Pelican (New)
Chevron Canada Resources Ltd.	Taber
Esso Resources Canada Ltd.	Fisher Creek Leduc Leming May/Ethel

	Rainbow
	Redwater
Excel Energy Inc.	Ardmore
Gulf Canada Resources Ltd.	Fenn-Big Valley*
Home Oil Company Ltd.	Kitscoty
Husky Oil	Caribou Lake Project (New)
	Kearl Lake*
Koch Exploration Canada Ltd.	Fort Kent
Mazzei Oil & Gas Ltd.	Frog Lake (New)*
Mobil Oil Canada, Ltd.	Iron River
	Kitscoty
	Wolf Lake
	Wolf Lake Extension (New)
Murphy Oil Company Ltd.	Lindbergh
	Morgan
Norcen Energy Resources Ltd.	Lindbergh I
	Lindbergh II
	Lindbergh III
	Horizontal Well (New)
	Provost (Bodo)*
PanCanadian Petroleum Ltd.	Countess B*
	Lindbergh
	Lindbergh - Elk Point
Petro-Canada Resources	Hangingstone I
	Hangingstone II
	Hangingstone III
	PCEJ (New)*
	Viking-Kinsella B
Renaissance Energy Ltd.	Horizontal Well (New)
Signalta Resources Ltd.	Pembina-Lobstick
Vikor Resources Ltd.	Joffre I*
	Joffre II*
Ulster Petroleums Ltd.	Retlaw*

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* AOSTRA Participation

Alberta Energy Company

Ipiatik Lake Phase A

LOCATION

LSD ___ Section: 1 Township: 73 Range: 6 W4M

PARTNERS:

Alberta Energy Company Limited	60%
Amoco Canada Petroleum Company Ltd.	30%
Deminex (Canada) Limited	10%

PROCESS: Cyclic Steam Stimulation
COST: Capital - $24,000,000 wells/facility/roads
START-UP: Spring 1984
TERMINATION: Terminated 87-12-3

DESCRIPTION

WELL PATTERN: Skewed 7-Spot
WELL SPACING: 1.46 ha/2.44 ha
NO. OF WELLS:

Injection/Production	11
Observation	2

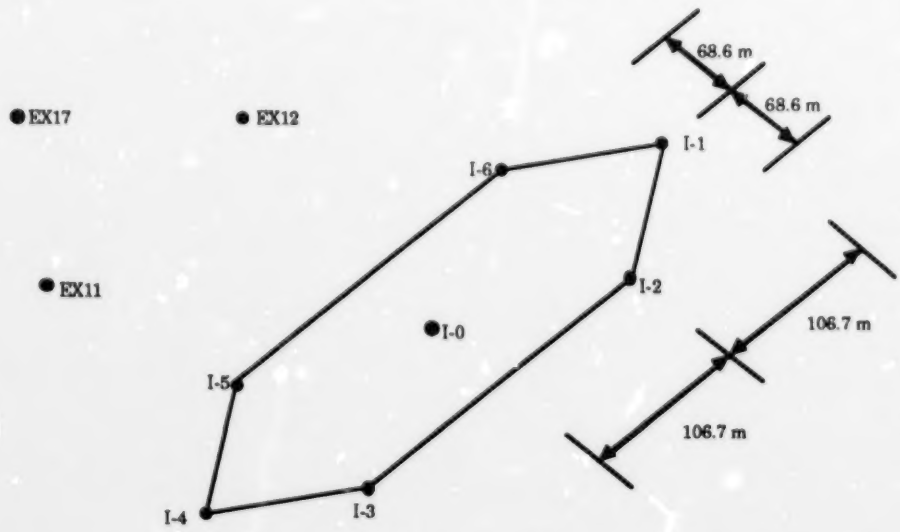
(monitoring temperature via thermocouples)

FACILITIES

STEAM GENERATOR(S): one - 53 GJ/hr steam generator
ARTIFICIAL LIFT METHODS: Standard Pump Jacks
TREATER TYPE: Conventional Electrostatic Treater
STORAGE FACILITIES: Field Tanks
TRANSPORT: Rail Transport

RESERVOIR

Geological Horizon:	Wabiskaw
Depth to Top of Formation:	450 m.KB
Reservoir Thickness:	
net:	25 m
gross:	29 m
Original Temperature:	16°C
Original Pressure:	2200 kPa
Average Horizontal Permeability:	n/a md
Average Porosity:	27%
Average Water Saturation S_w	20%
Average Oil Saturation S_o	80% pore volume
Oil Viscosity at Reservoir Temp.	n/a mPa.s
Oil Gravity at Reservoir Temp.	993 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator



Alberta Energy Company

Ipiatik Lake Phase B

LOCATION

LSD ___ Section: 2 Township: 73 Range: 6 W4M

PARTNERS:

Alberta Energy Company Limited
60%
Amoco Canada Petroleum Company Ltd.
30%
Deminex (Canada) Limited
10%

PROCESS: Cyclic Steam Stimulation
COST:
START-UP: January 1987
TERMINATION:

DESCRIPTION

PILOT AREA: 3.7 ha
WELL PATTERN: Regular 7-Spot
WELL SPACING: 2.43 ha
NO. OF WELLS: 7 Injection/Production

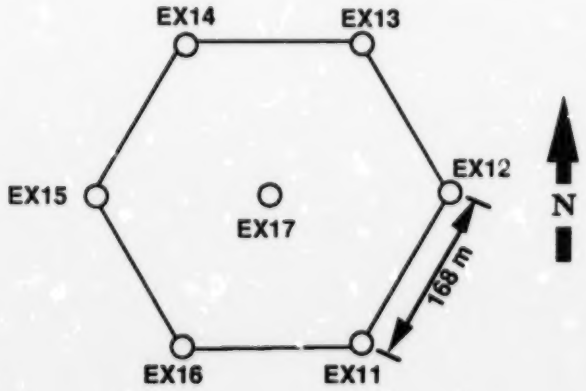
Note: Suspended 90-01-01

FACILITIES

STEAM GENERATOR(S): one - 53 GJ/hr steam generator
ARTIFICIAL LIFT METHODS: Standard Pump Jacks
TREATER TYPE: Conventional Electrostatic Treater
STORAGE FACILITIES: Field Tanks
TRANSPORT: Rail Transport

RESERVOIR

Geological Horizon:	Wabiskaw
Depth to Top of Formation:	450 m.KB
Reservoir Thickness:	
net:	25 m
gross:	29 m
Original Temperature:	16°C
Original Pressure:	2200 kPa
Average Horizontal Permeability:	n/a md
Average Porosity:	27%
Average Water Saturation S_w	20%
Average Oil Saturation S_o	80% pore volume
Oil Viscosity at Reservoir Temp.	n/a mPa.s
Oil Gravity at Reservoir Temp.	993 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator



Alberta Energy Company

Suffield I

LOCATION

LSD 4 Section: 10 Township: 20 Range: 8 W4M

PARTNERS:

AOSTRA	50%
Alberta Energy Company Ltd.	33.33%
Westcoast Petroleum Company Ltd.	16.66%

PROCESS: Wet Combustion
COST: Capital - $8,989,000 (to Dec. 31/88)
Operating - $7,481,000 (to Dec. 31/88)
START-UP: 1980
TERMINATION: February 1987, termination of wet combustion process. December 1988, termination of blowdown phase.

DESCRIPTION

PILOT AREA: 2 ha
WELL PATTERN: Inverted 5-Spot
WELL SPACING: 1 ha
NO. OF WELLS:

Injection	1 (1 - suspended)
Production	4 (2 - suspended)
Observation	3 (temperature monitoring only) (3 suspended)

FACILITIES

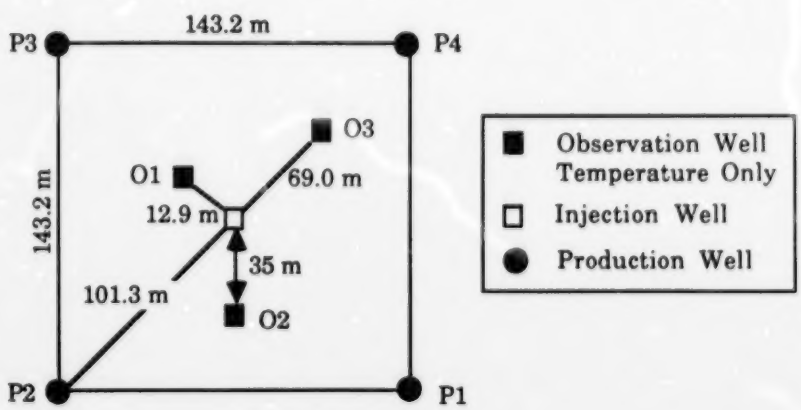
One air compressor - Capacity - 58,000 m^3/d @ 15.9 MPa

ARTIFICIAL LIFT METHODS: Conventional Beam Pump
TREATER TYPE: Pressure Heater-Treater
STORAGE FACILITIES: Oil - 620 m^3, Emulsion - 400 m^3, Water - 620 m^3
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	Glauconitic Sandstone
Depth to Top of Formation:	900 m.KB
Reservoir Thickness:	
net:	20 m
gross:	60 m
Original Temperature:	32°C
Original Pressure:	10,275 kPa
Average Horizontal Permeability:	480 md
Average Porosity:	27%
Average Water Saturation S_w	25%
Average Oil Saturation S_o	75% pore volume
Oil Viscosity at Reservoir Temp.	850-5000 mPa.s
Oil Gravity at Reservoir Temp.	974-992 Kg/m^3
Primary Production Rates:	1-10 m^3/well/day
Source:	Pilot Operator

COMMENTS: Phase A of Pilot Project completed December 31, 1986. Proceeding with Phase B of project which includes cyclic gas injection scheme, and blowdown of Phase A production wells which is reported separately.



Alberta Energy Company

Suffield II

LOCATION

LSD 11 Section: 34 Township: 19 Range: 8 W4M

PARTNERS:

Alberta Energy Company Limited
Westcoast Petroleum Ltd.
AOSTRA

PROCESS: Gas Injection Slug
START-UP: September 1987
TERMINATION: March 1988

DESCRIPTION

PILOT AREA: 2.86 ha
WELL PATTERN: Inverted 7-Spot
WELL SPACING: 0.9 ha/well
NO. OF WELLS:

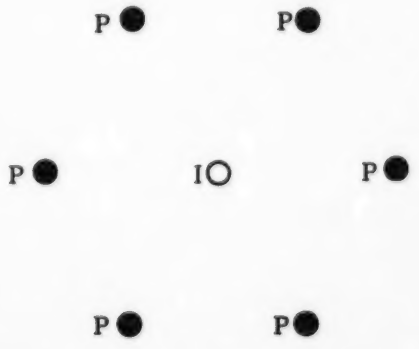
Injection (Common Wellbore)	1
Production	6

FACILITIES

GAS COMPRESSOR(S): one; rental only, Capacity: 14,000 (m^3/d @ 13.5 MPa)
ARTIFICIAL LIFT METHODS: Conventional Beam Pumpjack
TREATER TYPE: Pressure Heater Treater with Colt Evaporator Polisher
TRANSPORT: Pipeline

RESERVOIR

Location:	10-20-8W4
Geological Horizon:	Glauconite Sandstone
Depth to Top of Formation:	899.5 m.KB
Reservoir Thickness:	
net:	32 m
gross:	51 m
Original Temperature:	33°C
Original Pressure:	10515 kPa
Avg. Horizontal Perm.:	500-1000 md
Avg. Porosity:	27%
Avg. Water Saturation - S_w	25%
Avg. Oil Saturation S_o	75 pore vol.
Oil Viscosity at Res. Temp.	395 mPa.s
Oil Gravity at Res. Temp.	970-975Kg/m^3
Primary Production Rates:	1-15 m^3/well/day
Source:	Pilot Operator



Alberta Energy Company

Suffield Horizontal Well

LOCATION

LSD 6 Section: 34 Township: 19 Range: 8 W4M

PARTNERS:

Alberta Energy Company Limited	70%
Westcoast Petroleum Ltd.	30%

PROCESS: Horizontal Well
COST:
START-UP: October 1987
TERMINATION: In Progress

DESCRIPTION

PILOT AREA: Single well test (6-34-19-8 W4M) in Glauconite Sandstone
WELL PATTERN: Horizontal section extends 251 metres in oil pay.
WELL SPACING:
NO. OF WELLS: one

FACILITIES

ARTIFICIAL LIFT METHODS: Conventional Beam Pumpjack
TRANSPORT: Pipeline

RESERVOIR

Geological Horizon:	Glauconite Sandstone
Depth to Top of Formation:	938 m.KB
Reservoir Thickness:	
net:	15 m
gross:	18 m
Original Temperature:	30°C
Original Pressure:	10000 kPa
Average Horizontal Permeability:	1000 md
Average Porosity:	25%
Average Water Saturation S_w	25% pore vol.
Average Oil Saturation S_o	75% pore vol.
Oil Viscosity at Reservoir Temp.	395 mPa.s
Oil Gravity at Reservoir Temp.	9 7 0 - 9 7 5 Kg/m^3
Primary Production Rates:	m^3/well/day
Source:	Pilot Operator

Alberta Energy Company

Suffield Horizontal Well #2

LOCATION

LSD 6 Section: 3 Township: 20 Range: 8 W4M

PARTNERS:

Alberta Energy Company Limited	70%
Westcoast Petroleum Ltd.	30%

PROCESS: Horizontal Well
COST:
START-UP: February 1988
TERMINATION: In Progress

DESCRIPTION

PILOT AREA: Single well test (6-3-20-8 W4M) in Glauconite Sandstone
WELL PATTERN: Horizontal section extends 655 metres in oil pay.
WELL SPACING:
NO. OF WELLS: one

FACILITIES

ARTIFICIAL LIFT METHODS: Conventional Beam Pumpjack
TRANSPORT: Pipeline

RESERVOIR

Geological Horizon:	Glauconite Sandstone
Depth to Top of Formation:	938 m.KB
Reservoir Thickness:	
net:	8 m
gross:	m
Original Temperature:	30°C
Original Pressure:	10000 kPa
Average Horizontal Permeability:	1000 md
Average Porosity:	25%
Average Water Saturation S_w	25% pore vol.
Average Oil Saturation S_o	75% pore vol.
Oil Viscosity at Reservoir Temp.	395 mPa.s
Oil Gravity at Reservoir Temp. Kg/m^3	970 - 975
Primary Production Rates:	m^3/well/day
Source:	Pilot Operator

Alberta Energy Company

Suffield Hot Water Flood

LOCATION

NW/4 Section: 3 Township: 20 Range: 8 W4M

PARTNERS:

Alberta Energy Company Limited
Westcoast Petroleum Ltd.
AOSTRA

PROCESS: Hot Water Flood
COST: Capital - $620,000
Operating - $900,000
START-UP: 1988
TERMINATION: 1990

DESCRIPTION

PILOT AREA: 0.5 ha
WELL PATTERN: Inverted 4-Spot
WELL SPACING: S/B 0.33 ha/well
NO. OF WELLS:

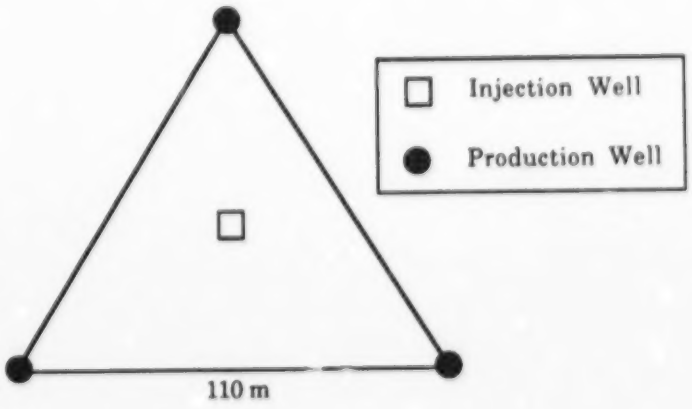
Injection	1
Production	3

FACILITIES

WATER HEATER: Indirect fired line heater (salt bath)
ARTIFICIAL LIFT METHODS: Beam Pump
TREATER TYPE: 4' x 24' 3 Phase Vertical
STORAGE FACILITIES: Central Battery
TRANSPORT: Pipeline

RESERVOIR

Geological Horizon:	Glauconite Sandstone
Depth to Top of Formation:	900 m.KB
Reservoir Thickness:	
net:	33 m
gross:	60 m
Original Temperature:	32°C
Original Pressure:	10275 kPa
Average Horizontal Permeability:	500-1000 md
Average Porosity:	27%
Average Water Saturation S_w	25%
Average Oil Saturation S_o	75% pore vol.
Oil Viscosity at Reservoir Temp.	400 mPa.s
Oil Gravity at Reservoir Temp.	970-975 Kg/m^3
Primary Production Rates:	1-15 m^3/well/day
Source:	AOSTRA



AOSTRA

Underground Test Facility

LOCATION

LSD 2,3,14 & 15 Section: 7,18 Township: 93 Range: 12 W4M

PARTNERS:
Access Stage - 100% AOSTRA
Phase A Process Tests
- AOSTRA
- Amoco Canada Petroleum Company Ltd.
- Canadian Centre for Mineral & Energy Technology
- Chevron Canada Resources Limited
- Mobil Oil Canada
- Petro-Canada Inc.
- Shell Canada Limited
- Texaco Canada Resources Ltd.

HASDrive Process
- AOSTRA
- Chevron Canada Resources Limited

PROCESS: Shaft & Tunnel Access to Horizontal Well Drilling.
Horizontal Well Processes:
(i) Steam-Assisted Gravity Drainage (SAGD)
(ii) Heated Annulus Steam Drive (HASDrive)
COST: Capital: $56,000,000 mine/wells/facilities/ roads
START-UP:
Mine Access: September 1986
Phase A Processes: November 1987
TERMINATION:
Phase A estimated 1990

DESCRIPTION

- Phase A: 1.0 ha
- HASDrive: 0.3 ha

WELL PATTERN:

Phase A: - 3 pairs of horizontal wells; 160 m length; end 60 m completed
- 26 m between wellpairs

HASDrive: 160 m horizontal heating well; vertical injector at far end; horizontal producer 60 m back on heating well

OBSERVATION WELLS:

Phase A: 29 wells containing a mix of temperature and geotechnical instrumentation

HASDrive: 7 temperature observation wells

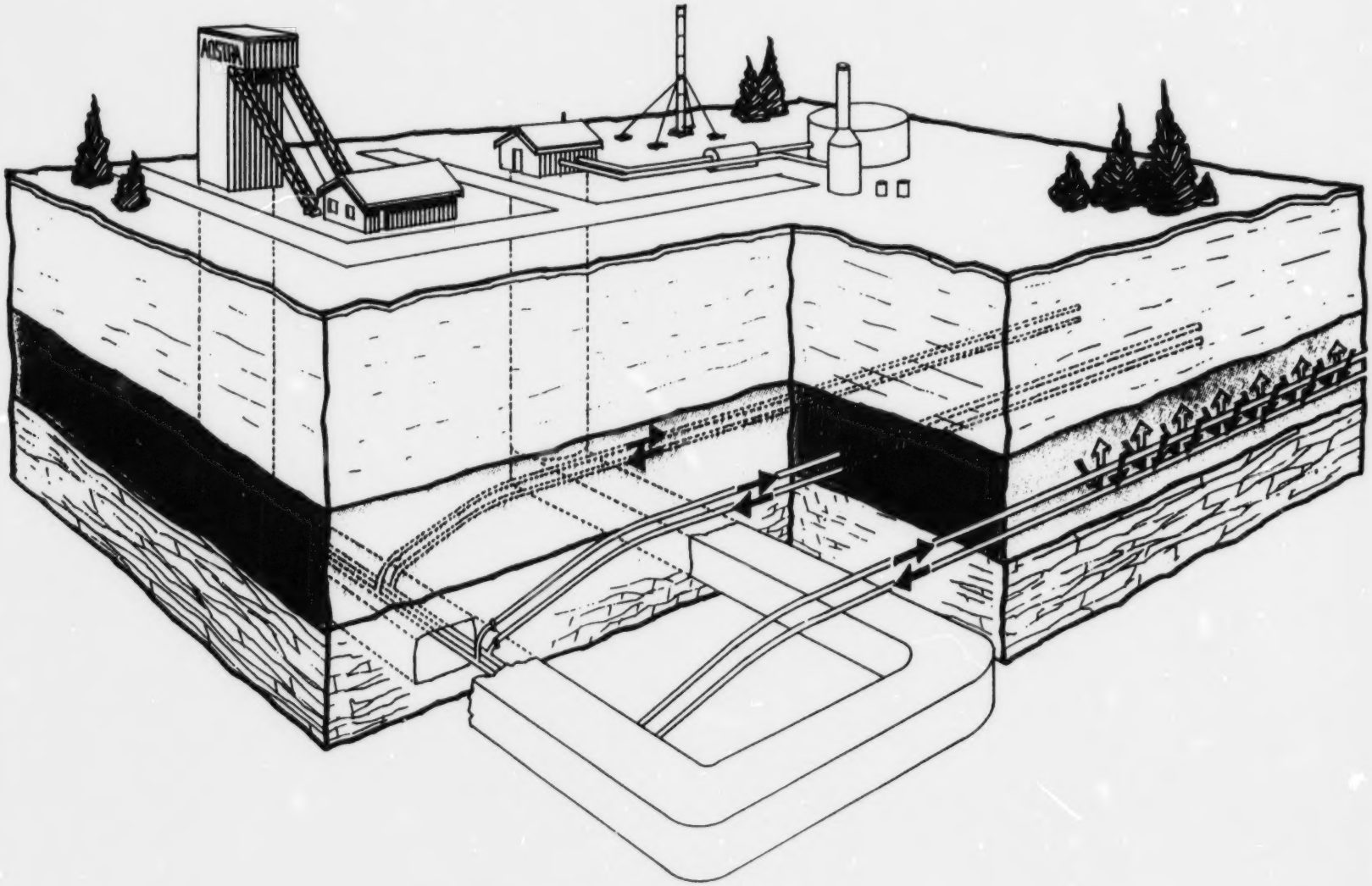
FACILITIES

MINE ACCESS:
Two 3-4 m I.D. access shafts 213 m deep; 930 m of tunnel, 5 m wide x 4 m high cross-section; high speed hoist in #1 shaft

PROCESS:
One 7,000,000 BTU/hr and one 25,000,000 BTU/hr. steam generator; pumping or steam lift if required; simple gas separation & shipment of produced fluids.

RESERVOIR

Geological Horizon:	McMurray
Depth to Top of Formation:	135 m.KB
Reservoir Thickness:	
net:	22 m
gross:	m
Original Temperature:	11°C
Original Pressure:	450 kPa
Average Horizontal Permeability:	4000 md
Average Porosity:	35%
Average Water Saturation - S_w	19%
Average Oil Saturation S_o	81% pore vol.
Oil Viscosity at Reservoir Temp.	1,000,000 mPa.s
Oil Gravity at Reservoir Temp.	1014 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	AOSTRA



UNDERGROUND TEST FACILITY

Amoco Canada Petroleum Company Ltd.
Atlee Buffalo

LOCATION
LSD __ Section: __ Township: __ Range: 5&6 W4M

PARTNERS:
Amoco Canada Petroleum Company Ltd. 100%

PROCESS: Combination Thermal Drive
COST:
Capital - $2.8 Million
Operating - $1.5 Million for 1985
START-UP: July 1983
TERMINATION: November 1987 Project shutin due to low oil prices.

DESCRIPTION

PILOT AREA: 240 ha
WELL PATTERN: Two irregular inverted 9-Spot patterns
WELL SPACING: 15 ha/well
NO. OF WELLS:

Injection	2
Production	14
Observation	0

FACILITIES

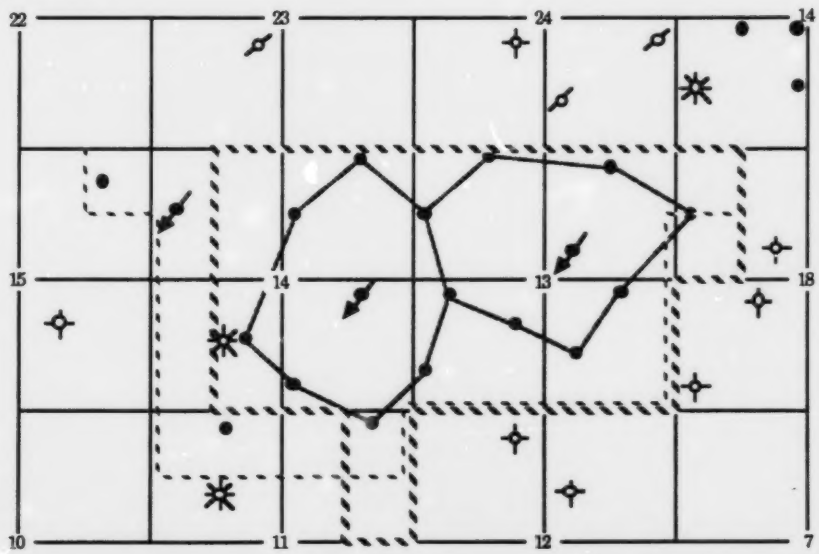
One - 98,600 m^3/d @ 12.4 MPa air compressor
ARTIFICIAL LIFT METHODS: Beam Pumps and Progressive Cavity Pumps

TREATER TYPE: Pressure treater
STORAGE FACILITIES: 1000 m^3 oil, 160 m^3 water, 160 m^3 emulsion
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	Glauconite
Depth to Top of Formation:	915 m.KB
Reservoir Thickness:	
net:	3.7 m
gross:	m
Original Temperature:	30.6°C
Original Pressure:	10300 kPa
Average Horizontal Permeability:	1800 md
Average Porosity:	24%
Average Water Saturation - S_w	34%
Average Oil Saturation S_o	66% pore vol.
Oil Viscosity at Reservoir Temp.	310 mPa.s
Oil Gravity at Reservoir Temp.	965 Kg/m^3
Primary Production Rates:	3.2 m^3/well/day
Source:	Pilot Operator

COMMENTS: Air is still being injected into the two patterns at rates of 100 MSCF/day/well.



Amoco Canada Petroleum Company Ltd.
Brintnell

LOCATION

LSD 6 Section: 24 Township: 81 Range: 23 W4M
LSD 10 Section: 15 Township: 81 Range 23 W4M
LSD: 5 Section: 1 Township: 81 Range 23 W4M
LSD: 7 Section: 23 Township: 80 Range 23 W4M
LSD: 5 Section: 24 Township: 80 Range 23 W4M

PARTNERS:
Amoco Canada Petroleum Company Ltd. 100%
PROCESS: Steam Stimulation
COST: N/A
START-UP: November 1985
TERMINATION: March 1986 (reactiv ated in 1988)

DESCRIPTION

Single Well Cyclic Steam Stimulation Program
WELL SPACING: 64.75 ha
NO. OF WELLS:
Injection/Production 25

FACILITIES

STEAM GENERATOR(S): one - 22 GJ/hr steam generator - portable
ARTIFICIAL LIFT METHODS: Beam Pump and Progressive Cavity Pumps
STORAGE FACILITIES: 120 m^3 Tanks

RESERVOIR

Geological Horizon:	Wabiskaw
Depth to Top of Formation:	425 m.KB
Reservoir Thickness:	
net:	7 m
gross:	15 m
Original Temperature:	28°C
Original Pressure:	2700 kPa
Average Horizontal Permeability:	n/a md
Average Porosity:	28%
Average Water Saturation S_w	35%
Average Oil Saturation S_o	65% pore vol.
Oil Viscosity at Reservoir Temp.	360 mPa.s
Oil Gravity at Reservoir Temp.	940 Kg/m^3
Primary Production Rates:	3 m^3/well/day
Source:	Pilot Operator

COMMENTS

This project was suspended in March, 1986 due to low heavy oil prices and reactivated in 1988. Two horizontal wells were drilled in 1988.

Amoco Canada Petroleum Company Ltd.
Cessford

LOCATION

LSD __ Section: 34,27,23,11,10,3 Township: 25 Range: 12 W4M

PARTNERS:

Initial Phase:	
Amoco Canada Petroleum Company Ltd.	54.1%
Esso	49.9%
Incremental Phase:	
AOSTRA	50.0%
Amoco Canada Petroleum Company Ltd.	27.05%
Sulpetro	22.95%

PROCESS: Caustic Polymer Flood
COST:
Capital - 2,500,000
Operating - $1,700,000/year
START-UP: Waterflooding in 1981, caustic flooding in July 1984, polymer flooding in January 1985.
TERMINATION: November 1992

DESCRIPTION

PILOT AREA: 260 ha
WELL PATTERN: Five 5-Spots and two line drive
WELL SPACING: 32 ha
NO. OF WELLS:

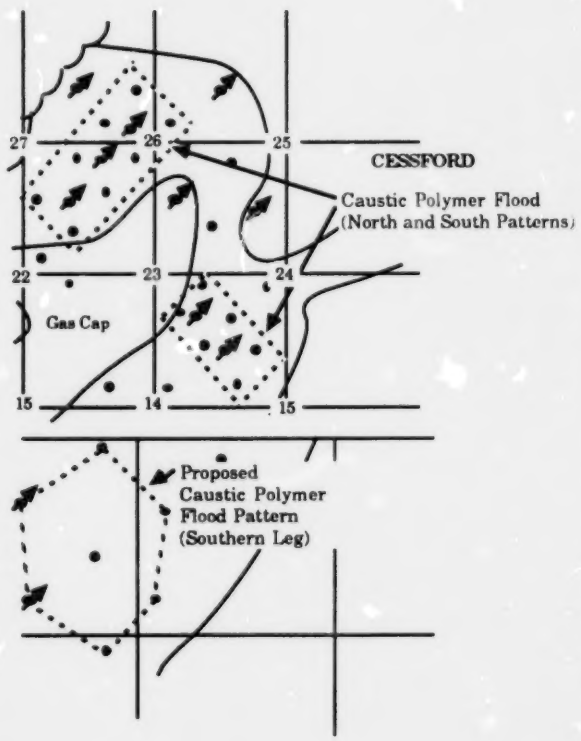
Injection	7
Production	19
Observation	0

FACILITIES

Water ion - exchange softeners with individual pumping units.
ARTIFICIAL LIFT METHODS: Conventional Beam Pumps
STORAGE FACILITIES: Tanks
TRANSPORT: Pipeline

RESERVOIR

Geological Horizon:	Basal Colorado A Sandstone
Depth to Top of Formation:	884-905 m.KB
Reservoir Thickness:	
net:	4 m
gross:	4 m
Original Temperature:	30°C
Original Pressure:	8720 kPa
Average Horizontal Permeability:	200-400 md
Average Porosity:	24%
Average Water Saturation S_w	30%
Average Oil Saturation S_o	70% pore vol.
Oil Viscosity at Reservoir Temp.	24 mPa.s
Oil Gravity at Reservoir Temp.	912 Kg/m^3
Primary Production Rates:	n/a m^3/well/day
Source:	Pilot Operator



Amoco Canada Petroleum Company Ltd.

David

LOCATION
LSD __ Section: 2&11 Township: 41 Range: 3 W4M

PARTNERS:

Amoco Canada Petroleum Company Ltd.	49%
Encor	24.75%
Others	

PROCESS: Alkaline Polymer Injection
COST: n/a
START-UP: 1986
TERMINATION: 1990

DESCRIPTION

PILOT AREA: 99 ha
WELL PATTERN: Irregular
WELL SPACING: 8 & 4 ha

NO. OF WELLS:

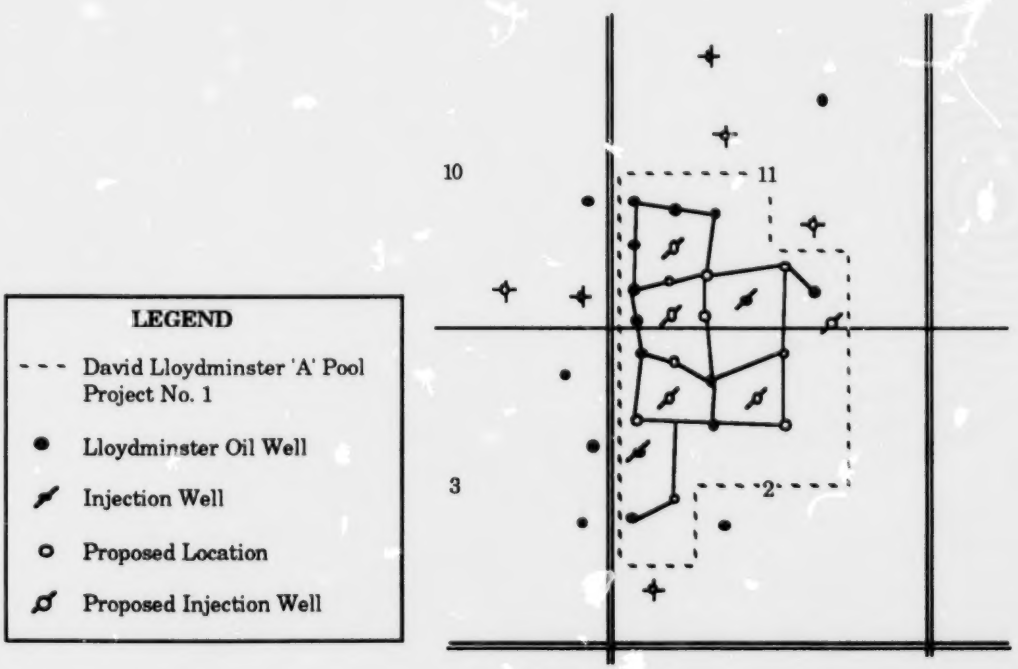
Injection	7
Production	21
Observation	0

FACILITIES

ARTIFICIAL LIFT METHODS: Pumps
TREATER TYPE: Pressure Treaters
STORAGE FACILITIES: Tanks
TRANSPORT: Pipeline

RESERVOIR

Geological Horizon:	Lloydminster
Depth to Top of Formation:	760 m.KB
Reservoir Thickness:	
net:	3.2 m
gross:	m
Original Temperature:	30.6°C
Original Pressure:	5580 kPa
Average Horizontal Permeability:	1480 md
Average Porosity:	29%
Average Water Saturation - S_w	27%
Average Oil Saturation S_o	73% pore vol.
Oil Viscosity at Reservoir Temp.	34.2 mPa.s
Oil Gravity at Reservoir Temp.	918 Kg/m^3
Primary Production Rates:	12 m^3/well/day
Source:	Pilot Operator



Amoco Canada Petroleum Company Ltd.
Drumheller Horizontal Well

LOCATION
LSD 14 Section: 13 Township: 29 Range: 20 W4M

PARTNERS:

Amoco Canada Petroleum Company Ltd.
Norcen Energy Resources Ltd.
Okanagan Petroleums Ltd.
Twin Richfield Ltd.
Voyager Energy Co.
N.L. Easley
S. Whipple

PROCESS: Short Radius Horizontal Well
COST: $936,000
START-UP: January 15, 1988
TERMINATION: Rig Release February 18, 1988; On Stream March 10, 1988

DESCRIPTION

PILOT AREA:
WELL PATTERN:
WELL SPACING: 80 acre in Sec. 13
NO. OF WELLS:
1 horizontal well drilled

FACILITIES

ARTIFICIAL LIFT METHODS: Reda Submersible Pump
TREATER TYPE:
STORAGE FACILITIES:
TRANSPORT:

RESERVOIR

Geological Horizon:	Nisku/Dolomite
Depth to Top of Form.:	Porosity top~ 830 ASL
Reservoir Thickness:	
net:	5 m
gross:	30 m
Original Temperature:	56°C
Original Pressure:	13,338 kPa
Average Horizontal Permeability:	40 md
Average Porosity:	7.5%
Average Water Saturation S_w	20%
Average Oil Saturation S_o	80% pore vol.
Oil Viscosity at Reservoir Temp.	1.3 mPa.s
Oil Gravity at Reservoir Temp.	850 Kg/m^3
Primary Prod. Rates:	Confidential m^3/well/day
Source:	

Amoco Canada Petroleum Company Ltd.
Gregoire Lake

LOCATION

LSD 5 Section: 2 Township: 86 Range: 7 W4M

PARTNERS:

AOSTRA	75%
Amoco Canada Petroleum Company Ltd.	12.5%
Petro-Canada Resources	12.5%

PROCESS: Steamflood with additives (CO_2 and/or Naphtha)
COST:
Initial Construction - $7,460,000
Operating - $14,500,000 (to Nov. 30/89)
START-UP: May 1985
TERMINATION: December 1989

DESCRIPTION

PILOT AREA: 0.28 ha
WELL PATTERN: Inverted 4-Spot
WELL SPACING: S/B 0.19 ha/well
NO. OF WELLS:

Injection	1
Production	3
Observation	3

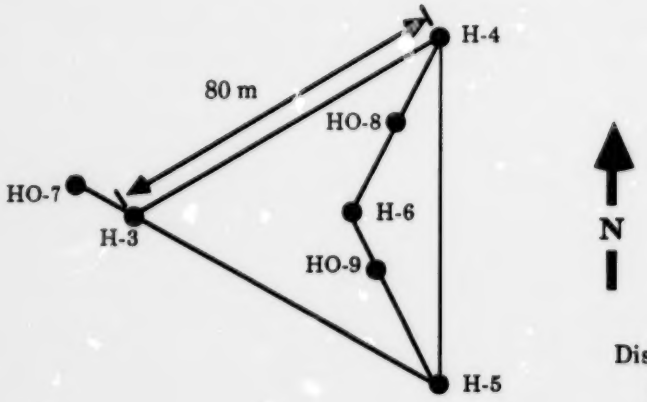
FACILITIES

STEAM GENERATOR(S): one - 26.4 GJ/hr
ARTIFICIAL LIFT METHODS: Conventional Beam Pump
TREATER TYPE: Atmospheric tankage plus diluent
STORAGE FACILITIES: 400 m^3 Bitumen/Diluent - 400 m^3 Emulsion - 400 m^3 Water
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	McMurray
Depth to Top of Formation:	187 m.KB
Reservoir Thickness:	
net:	41 m
gross:	47 m
Original Temperature:	10°C
Original Pressure:	531 kPa
Average Horizontal Permeability:	n/a md
Average Porosity:	36.4%
Average Water Saturation - S_w	25%
Average Oil Saturation S_o	75% pore vol.
Oil Viscosity at Res. Temp.	850,000 (est) mPa.s
Oil Gravity at Reservoir Temp.	1018 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator

COMMENTS:
Steaming operations initiated on October 27, 1986 to heat the production wellbores. A production cycle was started on January 16, 1987.



Distance From H-6
HO-8 25 m
HO-9 15 m

Amoco Canada Petroleum Company Ltd.
Morgan

LOCATION
LSD ___ Section: 35 Township: 51 Range: 4 W4M

PARTNERS:

Amoco Canada Petroleum Company Ltd. 100%

PROCESS: Cyclic Steam/Combination Thermal Drive
COST:
Capital - $22.3 Million
Operating - $3.9 Million for 1987
START-UP: June 1981
TERMINATION: 1995

DESCRIPTION

PILOT AREA: 260 ha
WELL PATTERN: Inverted 7-Spot
WELL SPACING: 4 ha/well
NO. OF WELLS:

Injection	7
Production	39
Observation	0

FACILITIES

STEAM GENERATOR(S): two - 26 GJ/hr
AIR COMPRESSORS: one - 90,600 m^3/d @ 6.9 MPa
ARTIFICIAL LIFT METHODS: HEP Units and liner pumps
TREATER TYPE: Pressure and Flash treaters
STORAGE FACILITIES: 1500 m^3 oil; 800 m^3 water
TRANSPORT: Husky Pipeline

RESERVOIR

Geological Horizon:	Lloydminster A
Depth to Top of Formation:	580 m.KB
Reservoir Thickness:	
net:	10 m
gross:	10 m
Original Temperature:	24°C
Original Pressure:	3230 kPa
Average Horizontal Permeability:	2000 md
Average Porosity:	30%
Average Water Saturation - S_w	25%
Average Oil Saturation S_o	75% pore vol.
Oil Viscosity at Reservoir Temp.	5688 mPa.s
Oil Gravity at Reservoir Temp.	973 Kg/m^3
Primary Production Rates:	2.2 m^3/well/day
Source:	Pilot Operator

COMMENTS: Air injection is marginally profitable at low oil prices. An air pressure up blow down strategy is being used successfully. Conversion of a pattern to combination thermal drive to be done in 1990.

Amoco Canada Petroleum Company Ltd.
Soars Lake (Beaverdam) (New Project)

LOCATION

LSD 14 Section: 19 Township: 59 Range: 1 W4M

PARTNERS:

Amoco Canada Petroleum Company Ltd. 100%

PROCESS: Steam Stimulation
COST: N/A
START-UP: June, 1988
TERMINATION:

DESCRIPTION

Single Well Cyclic Steam Stimulation Program

WELL SPACING: 4.047 ha
NO. OF WELLS:

Injection/Production	16
Observation	1

FACILITIES

STEAM GENERATOR(S): two 7.3 MW steam generators
ARTIFICIAL LIFT METHODS: HEP
STORAGE FACILITIES: Pressurized Treater, Treated Oil Trucked to Sales

RESERVOIR

Geological Horizon:	Sparky
Depth to Top of Formation:	450 m.KB
Reservoir Thickness:	
net:	10 m
gross:	20 m
Original Temperature:	22°C
Original Pressure:	2800 kPa
Average Horizontal Permeability:	1200 md
Average Porosity:	30%
Average Water Saturation - S_w	30%
Average Oil Saturation S_o	70% pore vol.
Oil Viscosity at Reservoir Temp.	20,000 mPa.s
Oil Gravity at Reservoir Temp.	985 Kg/m^3
Primary Production Rates:	2.0 m^3/well/day
Source:	Pilot Operator

COMMENTS

Steaming above fracture pressure began in June, 1988. Well-to-well interference and sand production problems were initially severe. Steaming strategy and completions were revised in 1989 to reduce these problems.

Amoco Canada Petroleum Company Ltd.
Soars Lake (Beaverdam) Old Project

LOCATION
LSD ___ Section: 13,14,23,24,25,26,35,36
Township: 59 Range: 2 W4M
LSD ___ Section: 19 Township: 59 Range: 1 W4M

PARTNERS:

Amoco Canada Petroleum Company Ltd. 100%

PROCESS: Steam Stimulation
COST: N/A
START-UP: June 1, 1985
TERMINATION: June 1, 1987 (reactivated in 1988).

DESCRIPTION

Single Well Cyclic Steam Stimulation Program

WELL SPACING: 64.75 ha
NO. OF WELLS:
Injection/Production 18

FACILITIES

STEAM GENERATOR(S): one 7.3 MW portable steam generator
ARTIFICIAL LIFT METHODS: Beam Pump and Progressive Cavity Pump
STORAGE FACILITIES: 120 m^3 Tanks

RESERVOIR

Geological Horizon:	Sparky
Depth to Top of Formation:	450 m.KB
Reservoir Thickness:	
net:	10 m
gross:	20 m
Original Temperature:	22°C
Original Pressure:	2800 kPa
Average Horizontal Permeability:	1200 md
Average Porosity:	30%
Average Water Saturation - S_w	30%
Average Oil Saturation S_o	70% pore vol.
Oil Viscosity at Reservoir Temp.	20,000 mPa.s
Oil Gravity at Reservoir Temp.	985 Kg/m^3
Primary Production Rates:	2.0 m^3/well/day
Source:	Pilot Operator

COMMENTS
This project was suspended in March, 1986 due to low heavy oil prices and reactivated in 1988.

Currently attempting to create voidage before considering additional steaming.

Bow Valley Industries Ltd.
Marie (Cold Lake)

LOCATION

LSD 7 Section: 14 Township: 65 Range: 2 W4M

PARTNERS:

AOSTRA	50%
Bow Valley Industries Ltd.	50%

These are current participating interests. Agreements between the parties provide for changes in interests as the project progresses through different phases.

PROCESS: Cyclic, frac assisted matrix injection scheme initially utilizing superheated steam, CO_2 and other chemical additives.
COST:
Capital: $10,205,000
Operating: $17,500,000
START-UP: January 15, 1985 (commencement of cyclic steam) Phase A, January 1987 for Phase AX
TERMINATION: December 31, 1990

DESCRIPTION

PILOT AREA: 8.8 ha for 2 patterns
WELL PATTERN: Skewed 7-Spot
WELL SPACING:
Initial Pilot: 0.9 ha spacing
Second Phase: 1.8 ha spacing
NO. OF WELLS:

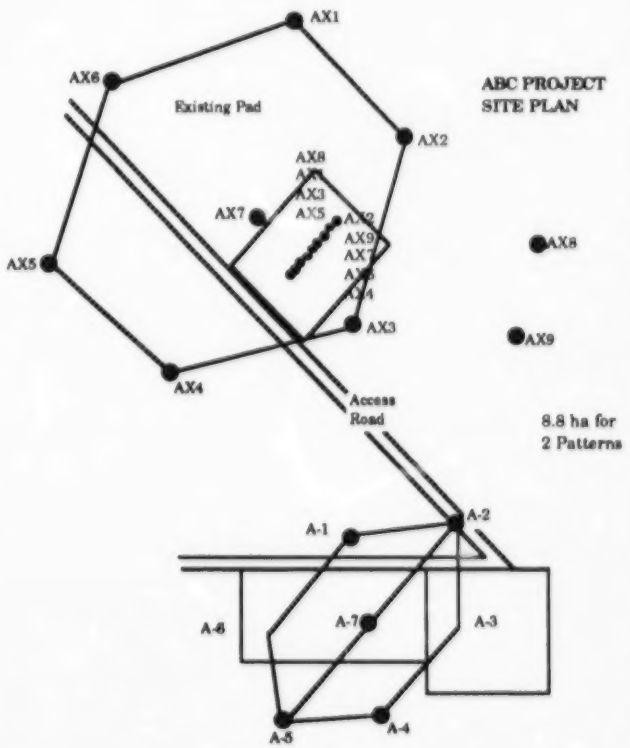
Injection/Production	16
Observation	3

FACILITIES

STEAM GENERATOR(S): two - 94.78 GJ/hr
ARTIFICIAL LIFT METHODS: Rod actuated bottomhole pumps, tubing and conventional pumpjacks
TREATER TYPE: Colt dehydrator
STORAGE FACILITIES:
FWKO = 318 m^3, coalescing tank - 636 m^3, settling tank = 119 m^3, Sales Oil Tank - 795 m^3, waste water skimmer tank - 318 m^3, waste water storage tanks 476 m^3

RESERVOIR

Geological Horizon:	Clearwater
Depth to Top of Formation:	420 m.KB
Reservoir Thickness:	
net:	(C-2 only) 8.5 m
	(C-3 only) 4.0 m
gross:	(C-2 only) 10.0 m
	(C-3 only) 4.0 m
Original Temperature:	11.5°C
Original Pressure:	3450 kPa
Average Horizontal Permeability:	2000 md
Average Porosity:	35%
Average Water Saturation - S_w	40%
Average Oil Saturation S_o	60% pore vol.
Oil Viscosity at Reservoir Temp.	500,000 mPa.s
Oil Gravity at Reservoir Temp.	1000 Kg/m^3
Primary Production Rates:	1 m^3/well/day
Source:	AOSTRA



BP Canada

Chauvin South Sparky 'E'

LOCATION

LSD NW/4 Section: 24 Township: 42 Range: 3 W4M
LSD SW/4 Section: 25 Township: 42 Range: 3 W4M
LSD NE/4 Section: 26 Township: 42 Range: 3 W4M

PARTNERS:
BP Canada 100%

PROCESS: Mobility control polymer flood (using Xanthan - biopolymer)
COST:
Capital - $370,000
Operating - $1,000,000 (chemical cost for 3 yrs. inj.)
- $120,000/yr (general)
START-UP: February 1988
TERMINATION: February 1992

DESCRIPTION

PILOT AREA: 794.25 ha
WELL PATTERN: 2 inverted 5-Spots; 1 partial peripheral injection pattern.
WELL SPACING: 16 ha
NO. OF WELLS:

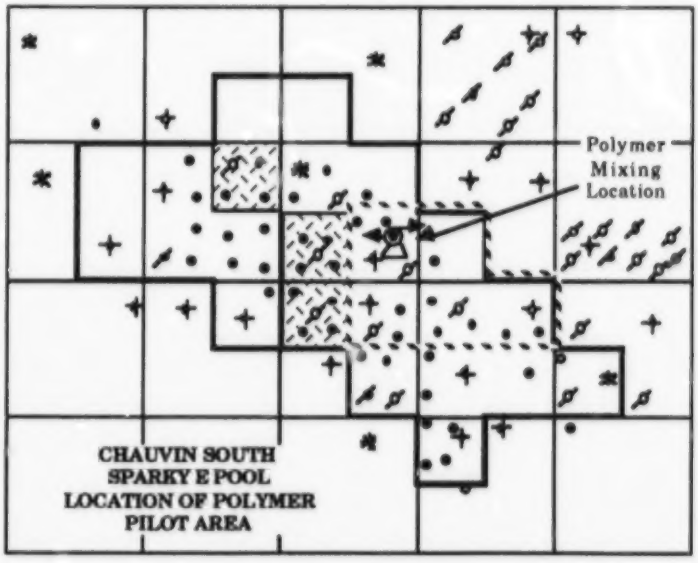
Production	11
Injection (polymer)	3

FACILITIES

One polymer blending unit
ARTIFICIAL LIFT METHODS: Standard Pump Jack and Bottomhole Rotary Pumps
TREATER TYPE: Standard Heater/Treater
STORAGE FACILITIES:
1 - 210 bbl Formaldehyde tank
1 - 750 bbl polymer tank
TRANSPORT: All wells flowlined.

RESERVOIR

Geological Horizon:	Third Sparky Sand of the Mannville Group
Depth to Top of Formation:	650 m.KB
Reservoir Thickness:	
net:	3.0 m
gross:	3.2 m
Original Temperature:	29°C
Original Pressure:	4785 kPa
Average Horizontal Permeability:	1200 md
Average Porosity:	30%
Average Water Saturation - S_w	19%
Average Oil Saturation S_o	81% pore vol.
Oil Viscosity at Reservoir Temp.	81 mPa.s
Oil Gravity at Reservoir Temp.	920 Kg/m^3
Primary Production Rates:	8 m^3/well/day
Source:	BP



BP Canada

Marguerite Lake Phase A

LOCATION
LSD 8, 9, 16, 5, 12, 13 Section: 7,9 Township: 66 Range: 5 W4M

PARTNERS:

AOSTRA	50%
BP Canada (Operator)	50%

PROCESS: Wet Combustion with O_2
COST:
Capital - $20,000,000
Operating - $30,000,000
START-UP: June 1978
TERMINATION: April 1987

DESCRIPTION

PILOT AREA: 20 ha over 4 patterns
WELL PATTERN: Four 5-Spot patterns with subsequent in-fill drilling
WELL SPACING: Initial 2 ha spacing
NO. OF WELLS:
Test area: 3 combustion test wells (1 injector; 2 producers) Main pattern 5 injectors, 16 producers.
1 non-operational well; 12 observation wells: 12 (12 for temperature only; 2 for temperature and pressure)

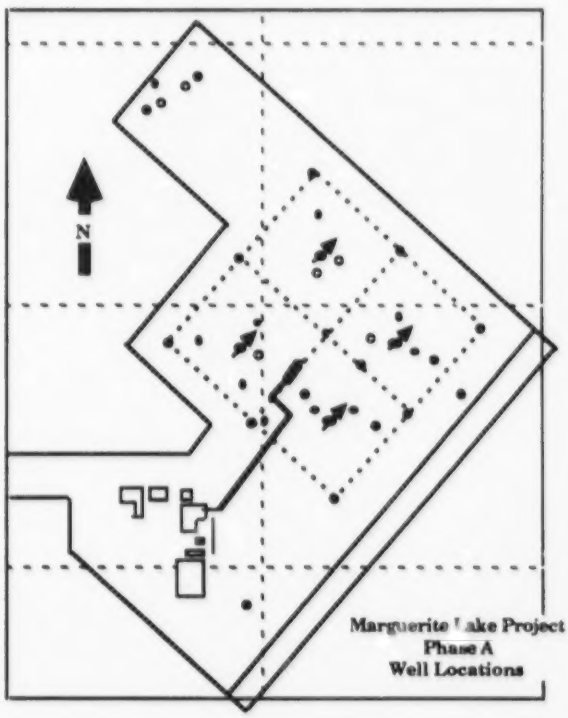
FACILITIES

STEAM GENERATOR(S): two - 53 GJ/hr
ARTIFICIAL LIFT METHODS: Standard Pump Jack
TREATER TYPE: 8' x 30' Cenatco
STORAGE FACILITIES: 3 - 499 m^3 oil, 1 - 800 m^3 water
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	Clearwater
Depth to Top of Formation:	440 m.KB
Reservoir Thickness:	
net:	23 m
gross:	35.4 m
Original Temperature:	16°C
Original Pressure:	2800 kPa
Average Horizontal Permeability:	1150 md
Average Porosity:	31%
Average Water Saturation	35%
Average Oil Saturation	65% pore volume
Oil Viscosity at Reservoir Temp.	100,000 mPa.s
Oil Gravity at Reservoir Temp.	993 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	AOSTRA

COMMENTS: This project terminated April 1, 1987. New Project (BP/PCI Project Owl) started on same location with new partner.



BP Canada/Petro-Canada Resources
Project Owl

LOCATION

LSD 8,9,16,5,12,13 Section: 7.9 Township: 66 Range: 5 W4M

PARTNERS:

Petro-Canada Resources	50%
BP Canada (Operator)	50%

PROCESS: Wet Combustion with O_2

COST:
Capital - $1,000,000
Operating - $7,000,000
START-UP: April 1987
TERMINATION: December 1988

DESCRIPTION

PILOT AREA: 20 ha over 4 patterns
WELL PATTERN: 4 5-Spot patterns with subsequent in-fill drilling
WELL SPACING: Initial 2 ha spacing
NO. OF WELLS:
Injection/Production 3 oxygen-water injectors, and 16 producers.
1 non-operational well 12 observation wells (12 for temperature only; 2 for temperature and pressure)

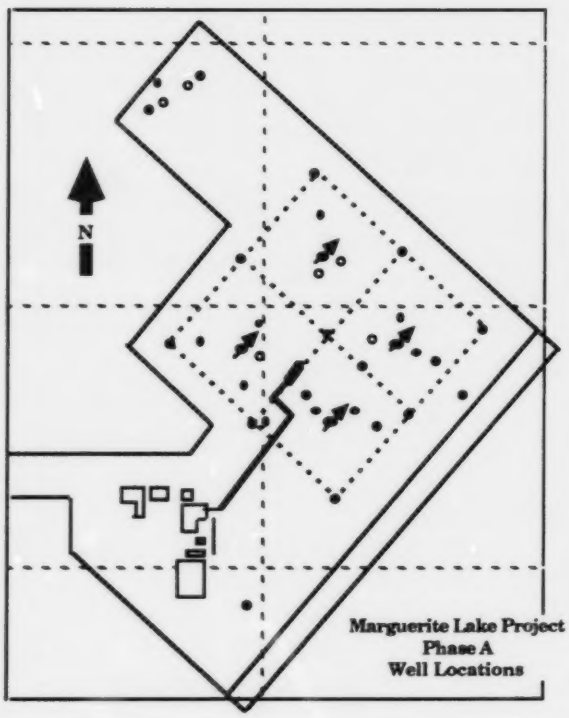
FACILITIES

STEAM GENERATOR(S): two - 53 GJ/hr
ARTIFICIAL LIFT METHODS: Standard Pump Jack
TREATER TYPE: 8' x 30' Cenatco
STORAGE FACILITIES: 3 - 499 m^3 oil, 1 - 800 m^3 water
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	Clearwater
Depth to Top of Formation:	440 m.KB
Reservoir Thickness:	
net:	23 m
gross:	35.4 m
Original Temperature:	16°C
Original Pressure:	2800 kPa
Average Horizontal Permeability:	1150 md
Average Porosity:	31%
Average Water Saturation	35%
Average Oil Saturation	65% pore volume
Oil Viscosity at Reservoir Temp.	100,000 mPa.s
Oil Gravity at Reservoir Temp.	993 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Project Operator

COMMENTS: Combustion development continued at Wolf Lake.



Bumper Development Corporation Ltd.
Twining Rundle 'A' Pool

LOCATION

LSD 12 Section: 16 Township: 31 Range: 24 W4M

PARTNERS:

Bumper Development Corporation Ltd.
Enron Oil Canada Ltd.
AOSTRA

PROCESS: Re-completion of a Pekisko oil well by drilling a single horizontal drainhole.
COST: $556,000
START-UP: October 1987
TERMINATION: January 1, 1992

DESCRIPTION

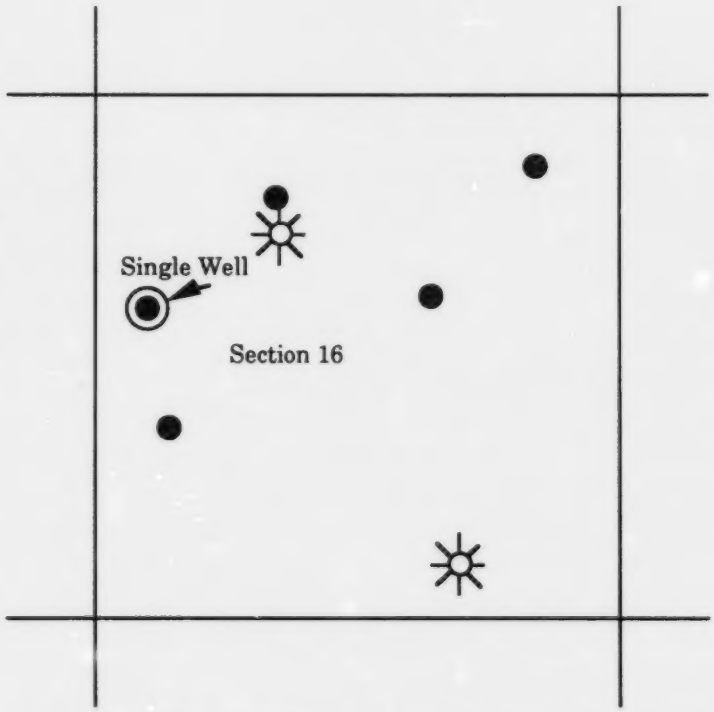
PILOT AREA: About 32 ha
WELL PATTERN: Single well
WELL SPACING: 32 ha
NO. OF WELLS:
One production well only.

FACILITIES

ARTIFICIAL LIFT METHOD: Reciprocating sub-surface pump.

RESERVOIR

Producing Formation:	Pekisko of the Twining Rundle 'A' Pool
Depth to Top of Formation:	1660 m.KB
Reservoir Thickness:	
net:	15 m
gross:	40 m
Original Temperature:	61°C
Original Pressure:	11410 kPa
Average Horizontal Permeability:	5 md
Average Porosity:	5.7%
Average Water Saturation	36%
Average Oil Saturation	64%
Oil Viscosity at Reservoir Temperature	1.6 mPa.s
Oil Gravity at Reservoir Temp	876 Kg/m^3
Primary Production Rates:	1 m^3/well/day
Source:	Pilot Operator



Canadian Hunter Exploration Ltd.
Swan Hills Beaverhill Lake

LOCATION

LSD 13 Section: 11 Township: 67 Range: 8 W4M

PARTNERS:

Canadian Hunter Exploration Ltd.	50%
AOSTRA	50%

PROCESS: Horizontal well recovery from a tight carbonate reservoir.
COST: $1,500,000 drill (not completed)
START-UP: January 1988
TERMINATION: n/a

DESCRIPTION

PILOT AREA: Single well
WELL PATTERN: n/a
WELL SPACING: n/a
NO. OF WELLS: 1

FACILITIES

STEAM GENERATOR(S): n/a
ARTIFICIAL LIFT METHODS: Conventional rod pump and pump jack
TREATER TYPE: n/a
STORAGE FACILITIES: n/a
TRANSPORT: Truck fluid out.

RESERVOIR

Geological Horizon:	Swan Hills Beaverhill Lake Formation
Depth to Top of Formation:	2268 m.KB
Reservoir Thickness:	
net:	m
gross:	14 m
Original Temperature:	83.5°C
Original Pressure:	21000 kPa
Average Horizontal Permeability:	n/a md
Average Porosity:	5%
Average Water Saturation - S_w	14%
Average Oil Saturation S_o	84% pore vol.
Oil Viscosity at Reservoir Temperature	n/a mPa.s
Oil Gravity at Surface Temp.	43°API
Primary Production Rates:	n/a m^3/well/day
Source:	Pilot Operator

Canada Northwest Energy Ltd.
Atlee - Buffalo

LOCATION

LSD __ Section: 19,20&30 SW4M Township: 21 Range: 5 W4M

PARTNERS:

Hexagon Gas	31.9771%
Murphy Oil	10.1835%
Canada Northwest Energy Ltd.	57.8394%

PROCESS: Cyclic Steam
COST: Capital - Using existing wells and facilities
START-UP: February 1, 1986
TERMINATION: Unknown at present.

DESCRIPTION

PILOT AREA: n/a
WELL PATTERN: Conventional 40 acre spacing at present.
WELL SPACING: 40 acre spacing
NO. OF WELLS:
10 huff and puff existing

FACILITIES

STEAM GENERATOR(S): one - 23.2 GJ/hr
ARTIFICIAL LIFT METHODS: Pump Jacks
TREATER TYPE: Colt
STORAGE FACILITIES:
TRANSPORT: Truck to Bow River Terminal at Jenner

RESERVOIR

Geological Horizon:	Glauconite
Depth to Top of Formation:	892 m.KB
Reservoir Thickness:	
net:	10 m
gross:	10 m
Original Temperature:	26°C
Original Pressure:	10000 kPa
Average Horizontal Permeability:	2000 md
Average Porosity:	29%
Average Water Saturation S_w	23%
Average Oil Saturation S_o	77% pore vol.
Oil Viscosity at Reservoir Temp.	800 mPa.s
Oil Gravity at Reservoir Temp.	951 Kg/m^3
Primary Production Rates:	less than 5 m^3/well/day
Source:	Pilot Operator

COMMENTS: Potential of steamflooding is being reviewed. Current reservoir pressure is too low to justify a large scale cyclic steam operation. The pilot project has been shut-in pending a resolution of an ownership problem.

Canadian Occidental Petroleum Ltd.
Manatokan Steam Project

LOCATION

LSD 1/2 Section: 13 Township: 63 Range: 8 W4M

PARTNERS:

Westcoast Petroleum Ltd. (Override royalty)

PROCESS: Huff'n puff/steam drive
COST: Capital $25 MM
START-UP: December 1985
TERMINATION: December 1990 - currently suspended September 1988

DESCRIPTION

PILOT AREA: 48 ha (subsurface - pad drilling)
WELL PATTERN: 12 inverted 5-Spot patterns (4 ha spacing)
WELL SPACING: 2 ha
NO. OF WELLS:

Injection	32
Production	32
Observation	(+ 1 tentative) 1

Note: All wells are steamed then produced.

FACILITIES

STEAM GENERATOR(S): three - 52.76 GJ/hr steam generators
ARTIFICIAL LIFT METHODS: Slant hole conventional
TREATER TYPE: Heater treater and evaporator dehydrator (polishing unit)
STORAGE FACILITIES: four 63.5 m^3 insulated tanks
TRANSPORT: Truck oil to Murphy Blackfoot truck terminal in Lloydminster area.

RESERVOIR

Geological Horizon:	Lower Grand Rapids Formation
Depth to Top of Formation:	370 m.KB
Reservoir Thickness:	
net:	12 m
gross:	22 m
Original Temperature:	20°C
Original Pressure:	3600 kPa
Average Horizontal Permeability:	1000 md
Average Porosity:	31%
Average Water Saturation - S_w	30%
Average Oil Saturation S_o	70% pore vol.
Oil Viscosity at Reservoir Temp.	90000 mPa.s
Oil Gravity at Reservoir Temp.	993 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator

Canadian Occidental Petroleum Ltd.
Morgan

LOCATION

LSD 10 Section: 34 Township: 51 Range:4 W4M

PARTNERS:

Canadian Occidental Petroleum Ltd. 100%

PROCESS: Fireflood; ran on cyclic steam, currently on primary.
COST: Capital - $8.2 million
START-UP: February 1986
TERMINATION: February 1991 - Steam suspended July 1988

DESCRIPTION

PILOT AREA: 16 ha
WELL PATTERN: 4, 4 ha inverted 5-Spots
WELL SPACING: 2 ha
NO. OF WELLS:

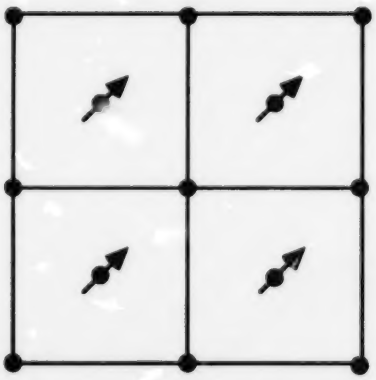
Injection	4
Production	9
Observation	0

FACILITIES

STEAM GENERATOR(S): one - 0.44 GJ/hr steam generator for pre-heat
ARTIFICIAL LIFT METHODS: Hydraulic pumping units; progressive cavity
TREATER TYPE: HTI (electronic) and Cold (distillation) polishing unit
STORAGE FACILITIES: 13 tanks (1684 m^3 total capacity)
TRANSPORT: Husky's Cold Lake Heavy Oil Pipeline (tie-in on site)

RESERVOIR

Geological Horizon:	Lloydminster Formation
Depth to Top of Formation:	570 TVD m.KB
Reservoir Thickness:	
net:	7 TVD m
gross:	11 TVD m
Original Temperature:	23°C
Original Pressure:	3200 kPa
Average Horizontal Permeability:	3000 md
Average Porosity:	28%
Average Water Saturation - S_w	25%
Average Oil Saturation S_o	75% pore vol.
Oil Viscosity at Reservoir Temp.	4600 mPa.s
Oil Gravity at Reservoir Temp.	988 Kg/m^3
Primary Production Rates:	2.0 m^3/well/day
Source:	Pilot Operator



Chevron Canada Resources Ltd.
Taber

LOCATION

LSD 9 Section: 18 Township: 9 Range: 16 W4M

PARTNERS:

Lonlife Resources	5.9%
Anadarko	4.3%
Koch Exploration	2.8%
Norcen Energy Ltd.	1.7%
Other	2.6%

PROCESS: Polymer Flood
COST:
Capital - $1.3 Million
Operating - $1.15 Million/year
START-UP: June 1987 (commenced continuous polymer injection)
TERMINATION: 1994

DESCRIPTION

PILOT AREA: 194 ha
WELL PATTERN: Irregular pattern
WELL SPACING: 16 ha
NO. OF WELLS:

Injection	2
Production	7
Observation	0

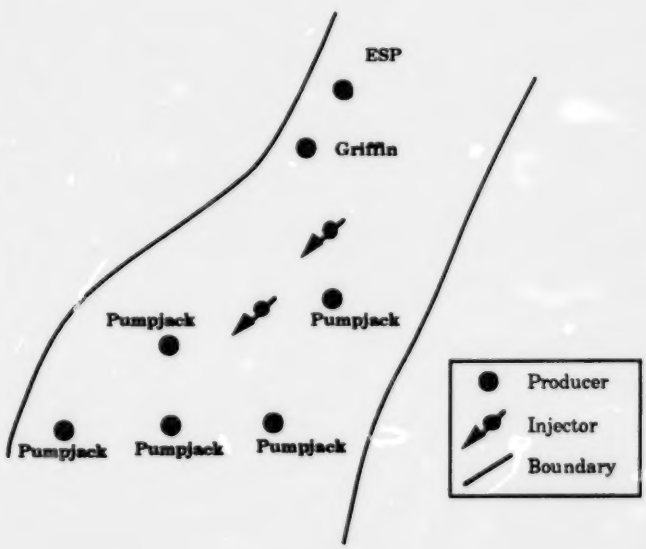
FACILITIES

ARTIFICIAL LIFT METHODS: 5 Pump Jacks, 1 electrical sub pump, 1 pump progressing cavity
TREATER TYPE: C.E. NATCO - dual polarity
STORAGE FACILITIES: 2 - 80 m^3 tanks
TRANSPORT: Pipeline

RESERVOIR

Geological Horizon:	Upper Mannville Glauconitic Sandstone
Depth to Top of Formation:	971 m.KB
Reservoir Thickness:	
net:	81 m
gross:	9.0 m
Original Temperature:	35°C
Original Pressure:	10170 kPa
Average Horizontal Permeability:	1140 md
Average Porosity:	22.3%
Average Initial Water Saturation S_w	25%
Average Oil Saturation S_o	initial 75% pore vol.
	current 49.4% pore vol.
Oil Viscosity at Reservoir Temp.	55 mPa.s
Oil Gravity at Reservoir Temp.	900 Kg/m^3
Primary Production Rates:	Max. 25 m^3/well/day
	Avg. 7 m^3/well/day
Source:	Chevron

COMMENTS: Polymer slug is tapered during last 4 years. The scheme is classified as expeimental and encompasses 2/3 of the entire pool in unit 1. Note: The pilot is still operating.



CS Resources

Pelican

LOCATION
LSD ___ Section: 3-17 Township: 81 Range: 22 W4M

PARTNERS:

C.S. Resources Ltd 100%
Deuvan Petroleum Ltd.

PROCESS: Primary Production only
COST: N/A
START-UP: 1980 Primary, 1981-1986 Fireflood, 1983-Present Cyclic Steaming
TERMINATION: Pilot Terminated May 1989

DESCRIPTION

PILOT AREA: Post-Combustion Primary, Water and Steam Flood
WELL PATTERN: 9 Inverted 30 Acre 17 Spot Patterns
OUTER PILOT AREA: Primary, Cyclic Steaming, Horizontal wells
WELL PATTERN: Single Wells
WELL SPACING: See Above
NO. OF WELLS:
13 Vertical Wells
8 Horizontal Wells

FACILITIES

STEAM GENERATOR:
ARTIFICIAL LIFT METHODS: Lufkin, Griffin, Corod, EMIP
TREATER TYPE: Atmospheric
STORAGE FACILITIES:
Single Wells - 750 BBl Tanks
Others - Group/Test Tanks
TRANSPORT:
Pilot - Underground to treating facilities
Outer Area - Tank Trucks

RESERVOIR

Geological Horizon:	Wabiskaw - McMurray
Depth to Top of Formation:	400 m.KB
Reservoir Thickness:	
net:	3.5-6.5 m
gross:	6.5 m
Original Temperature:	18°C
Original Pressure:	2375 kPa
Average Horizontal Permeability:	1000 md
Average Porosity:	26%
Average Water Saturation - S_w	30%
Average Oil Saturation S_o	70% pore volume
Oil Viscosity at Reservoir Temp.	800-1200 mPa.s
Oil Gravity at Reservoir Temp.	973 Kg/m^3
Primary Production Rates:	2.8 m^3/well/day
Source:	Pilot Operator

COMMENTS: In Mid-1989, Gulf Canada Resources transferred its 100% ownership in the "Pelican project to C.S. Resources of Calgary. Prior to the transfer, Gulf abandoned the fireflood project and the majority of the single well installations. C.S. Resources retained 12 single wells and the 8 horizontal wells as well as the treating facilities. C.S. Resources have continued to operate the retained facilities in primary production mode only.

Esso Resources Canada Ltd.

Fisher Creek

LOCATION
LSD 3 Section: 1 Township: 67 Range: 6 W4M

PARTNERS:

Esso Farm in on AEC lands.

PROCESS: Cyclic Steam Stimulation
COST:
Capital - $1.3 Million (10 km perm. access road) + $0.5 Million (facilities)
Operating - $0.8 Million (Rental, trucking, etc.)
START-UP: 1986
TERMINATION: Currently on hold, pending completion of production/injection data study.

DESCRIPTION

PILOT AREA:
WELL PATTERN: Single well pilot.
WELL SPACING: n/a
NO. OF WELLS:
Injection/Production - single well pilot

FACILITIES

STEAM GENERATOR(S): Portable equipment used, currently not on site. 31.7 GJ/hr.
ARTIFICIAL LIFT METHODS: Pump-jack 4w co-rod etc.
TREATER TYPE: Atmospheric Treater
STORAGE FACILITIES: Tank Farm
TRANSPORT: Truck - all fluids

RESERVOIR

Geological Horizon:	Clearwater
Depth to Top of Formation:	460 m.KB
Reservoir Thickness:	
net:	m
gross:	15-50 m
Original Temperature:	15°C
Original Pressure:	3000 kPa
Average Horizontal Permeability:	700 md
Average Porosity:	29%
Average Water Saturation S_w	0.54-0.68%
Average Oil Saturation S_o	0.46-0.32% pore vol.
Oil Viscosity at Res. Temp.	30000-100000 mPa.s
Oil Gravity at Reservoir Temp.	980 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator

COMMENTS: Operations suspeneded August, 1986. Analysis followed and a report was issued February, 1988. No further work is planned at this time.

Esso Resources Canada Ltd.

Leduc

LOCATION
LSD 8 Section: 17 Township: 50 Range: 26 W4M

PARTNERS:
Esso Resources Canada Ltd.
Leduc Woodbend D-2 Unit

PROCESS: Hydro carbon miscible flood (propane) following brine pre-flush
COST: n/a
START-UP: September 1985
TERMINATION: May 1988

DESCRIPTION

WELL SPACING: See plot plan
NO. OF WELLS:

Injection	1
Production	1
Observation	1

FACILITIES

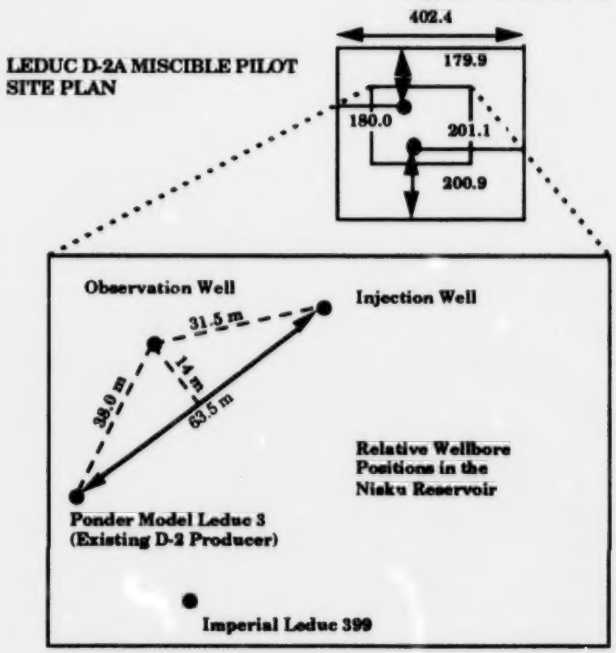
ARTIFICIAL LIFT METHODS: Rod Pump
TREATER TYPE: 3 phase separator
STORAGE FACILITIES: Brine & Propane tanks for Injection

TRANSPORT: Injected fluids are trucked. Produced fluids are transported through existing flowlines.

RESERVOIR

Geological Horizon:	Nisku
Depth to Top of Formation:	1550 m.KB
Reservoir Thickness:	
net:	n/a m
gross:	45 m
Original Temperature:	63°C
Original Pressure:	12300 kPa
Average Horizontal Permeability:	10 md
Average Porosity:	3.7%
Average Water Saturation S_w	26%
Average Oil Saturation S_o	34% pore vol.
Oil Viscosity at Reservoir Temp.	0.6 mPa.s
Oil Gravity at Reservoir Temp.	730 Kg/m^3
Primary Production Rates:	30 m^3/well/day
Source:	Pilot Operator

COMMENTS: The pilot is located at 8-17-50-26 W4M and consists of an injector producer pair. One observation well was drilled in October, 1987 and a sponge core taken. The oil saturation was measured by interwell tracer, sponge core and single well tracer. All three methods yielded the same answer.



Esso Resources Canada Ltd.

Leming

LOCATION
LSD __ Section: 4-8 Township: 65 Range: 3 W4M
PARTNERS:
Esso Resources Canada Ltd.
100%
PROCESS: Cyclic Steam Stimulation, Displacement, Horizontal Wells
COST: Capital - $227 Million
START-UP: January 1975
TERMINATION: On going

DESCRIPTION

PILOT AREA: 1295 ha
WELL PATTERN: Various cluster patterns - see diagram
WELL SPACING: 0.7, 0.8, 0.94, 1.6, 2.9 ha
NO. OF WELLS:

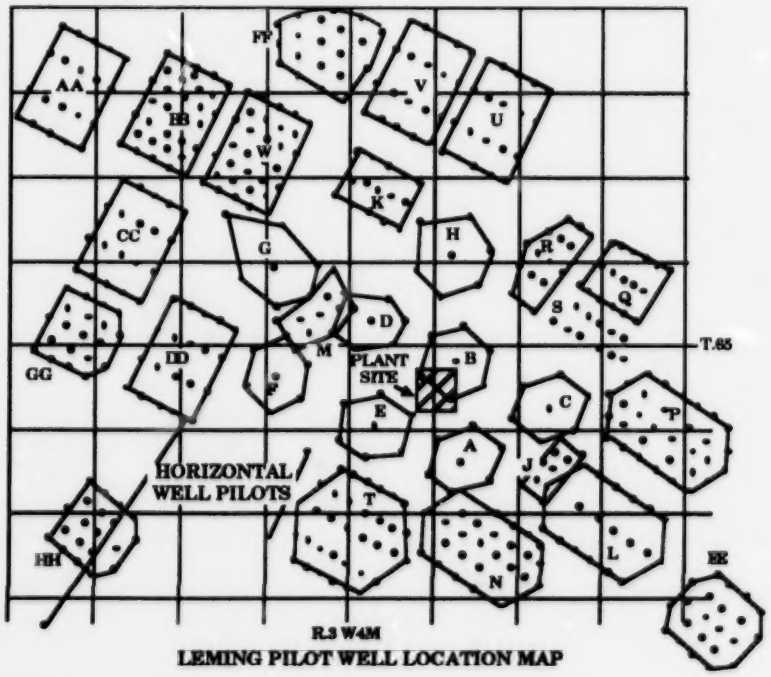
Injection/Production	496
Observation	55

FACILITIES

STEAM GENERATOR(S):
2 - 137.3 GJ/hr. (Produced water)
1 - 156.3 GJ/hr. (Fresh water)
2 - 52.75 GJ/hr. (Fresh water)
5 - 42.3 GJ/hr. (Fresh water)
Generator ratings are based on heat input to the water.
ARTIFICIAL LIFT METHODS: Pump Jacks, Hydro-beam, HEP
TREATER TYPE: Electro Static Grid (NATCO)
STORAGE FACILITIES: Tankage
TRANSPORT: Pipeline

RESERVOIR

Geological Horizon:	Clearwater
Depth to Top of Formation:	440 m.KB
Reservoir Thickness:	
net:	45 m
gross:	50 m
Original Temperature:	13°C
Original Pressure:	3100 kPa
Average Horizontal Permeability:	1500 md
Average Porosity:	35%
Average Water Saturation - S_w	30%
Average Oil Saturation S_o	70% pore vol.
Oil Viscosity at Reservoir Temp.	100000 mPa.s
Oil Gravity at Reservoir Temp.	995 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator



LEMING PILOT WELL LOCATION MAP

Esso Resources Canada Ltd.

May/Ethel

LOCATION
LSD ___ Section: 22,27,28 Township: 64 Range: 3 W4M

PARTNERS:

Esso Resources Canada Ltd. 100%

PROCESS: Cyclic Steam Stimulation and Displacement
COST: Capital - $70 Million
START-UP: May - 1972
Ethel - 1964 (Abandoned)
TERMINATION: Ongoing

DESCRIPTION

PILOT AREA: 777 ha
WELL PATTERN: See Diagram
WELL SPACING: 1 and 2 ha
NO. OF WELLS:

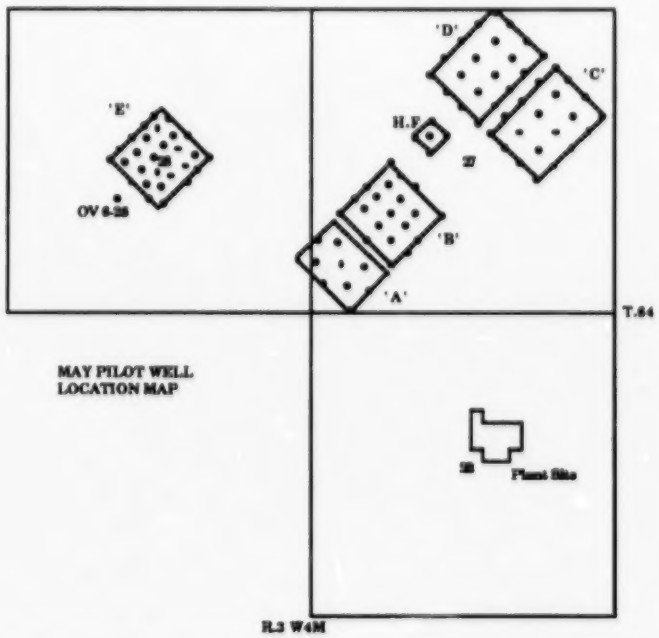
Injection/Production	106
Observation	8

FACILITIES

STEAM GENERATOR(S): 4 - 52.75 GJ/hr, 1 26.00 GJ/hr, 1 - 10.60 GJ/hr
ARTIFICIAL LIFT METHODS: Standard Pump Jacks
TREATER TYPE: Electrostatic Grid (NATCO)
STORAGE FACILITIES: Tankage
TRANSPORT: Pipeline

RESERVOIR

Geological Horizon:	Clearwater
Depth to Top of Formation:	440 m.KB
Reservoir Thickness:	
net:	45 m
gross:	55 m
Original Temperature:	13°C
Original Pressure:	3033 kPa
Average Horizontal Permeability:	1500 md
Average Porosity:	35%
Average Water Saturation - S_w	30%
Average Oil Saturation S_o	70% pore vol.
Oil Viscosity at Reservoir Temp.	100000 mPa.s
Oil Gravity at Reservoir Temp.	95 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator



Esso Resources Canada Ltd.

Rainbow

LOCATION
LSD 3 Section: 11 Township: 110 Range: 7 W6M

PARTNERS:

Esso Resources Canada Limited	100%

PROCESS: Drainhole in bottom water drive pool.
COST:
Capital: 1.32 M$
Operating: 30 K$/year
START-UP: April 9, 1987
TERMINATION: None

DESCRIPTION

PILOT AREA: 65 ha
WELL PATTERN: N/A
NO. OF WELLS:

Injection	0
Production	1
Observation	0

FACILITIES

ARTIFICIAL LIFT METHODS: Pump Jack

RESERVOIR

Geological Horizon:	Keg River
Depth to Top of Formation:	1,670 m.KB
Reservoir Thickness:	
net:	19.6 m
gross:	23 m
Original Temperature:	84°C
Original Pressure:	15,620 kPa
Average Horizontal Permeability:	200 md
Average Porosity:	4.5%
Average Water Saturation S_w	22%
Average Oil Saturation S_o	78% pore volume
Oil Viscosity at Reservoir Temp.	n/a mPa.s
Oil Gravity at Reservoir Temp.	797 Kg/m^3
Primary Production Rates:	60 m^3/well/day
Source:	Pilot Operator

Esso Resources Canada Ltd.

Redwater

LOCATION
LSD All Section: 29 Township: 57 Range: 21 W4M
LSD 4,5,12&13 Section: 28 Township: 57 Range: 21 W4M
LSD 1,2,3,4 Section: 32 Township: 57 Range: 21 W4M
LSD 4 Section: 33 Township: 57 Range: 21 W4M

PARTNERS:
Esso Resources Canada Ltd. 100%
PROCESS: Enriched Hydrocarbon Miscible Flood
COST: (Cumulative to date)
Capital - $4.8 Million
Operating - $13.1 Million
START-UP: January 1985
TERMINATION: January 1994

DESCRIPTION

PILOT AREA: 404.7 ha
WELL PATTERN: 4 inverted 5-spot injection patterns
WELL SPACING: 8.094 ha
PATTERN SPACING: 16.2 ha
NO. OF WELLS:

Injection	4
Production (in the injection patterns)	9

16 producers to contain the injection patterns

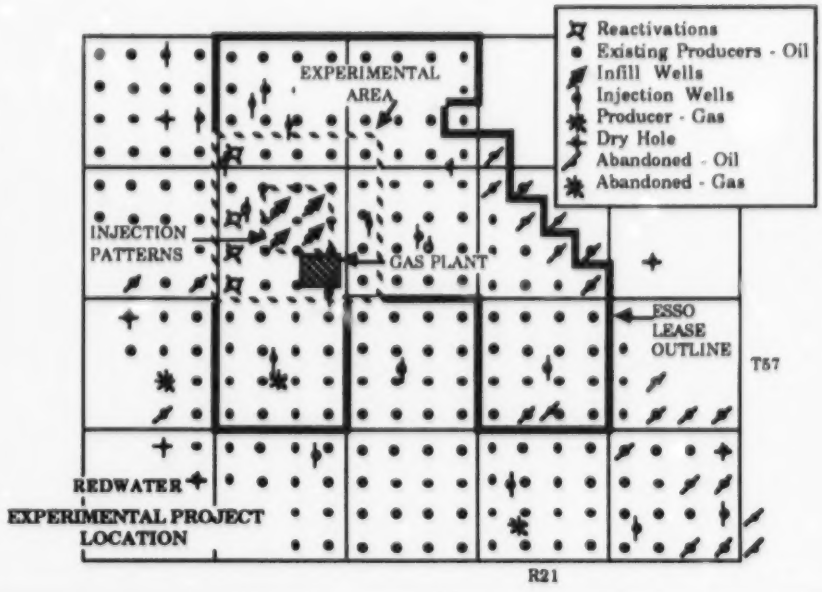
FACILITIES

One gas compressor: 28,000 m^3/d @ 9.7 MPa capacity
ARTIFICIAL LIFT METHODS: Electric Submersible pumps
TRANSPORT: NGL Pipeline

RESERVOIR

Geological Horizon:	Upper Devonian Leduc D3
Depth to Top of Formation:	903 m.KB
Reservoir Thickness:	
net:	31.39 m
gross:	m
Original Temperature:	34.6°C
Original Pressure:	7450 kPa
Average Horizontal Perm.:	40-200 (Foreslope) md 100-1500 (Backreef) md
Average Porosity:	6%(Backreef) 12% (Foreslope)
Average Water Saturation S_w	25%
Average Oil Saturation S_o	75% pore vol.
Oil Viscosity at Reservoir Temp.	2.7 mPa.s
Oil Gravity at Reservoir Temp.	844 Kg/m^3
Primary Production Rates:	1-8 m^3/well/day
Source:	Pilot Operator

COMMENTS: The first pattern was flooded beginning October, 1987 for approximately 6 months. The second pattern was flooded in the first half of 1989. Solvent injection into the third and fourth patterns is scheduled for mid 1990 and 1991 respectively. Chase gas injection into all four patterns will follow completion of solvent injection.



Excel Energy Inc.

Excel Ardmore

LOCATION

LSD 11,12,13,14 Section: 20 Township: 62 Range: 3 W4M

PARTNERS:

Excel Energy Inc.	65%
Koch Exploration Ltd.	35%

PROCESS: Steam Stimulation/Steam Drive
COST: Operating: $45,000/month
START-UP: September 1, 1975
TERMINATION: July 1, 1989

DESCRIPTION

PILOT AREA: 32.4 ha
WELL PATTERN: 5-Spot pattern
WELL SPACING: 1.02 ha and 2.04 ha/well
NO. OF WELLS:

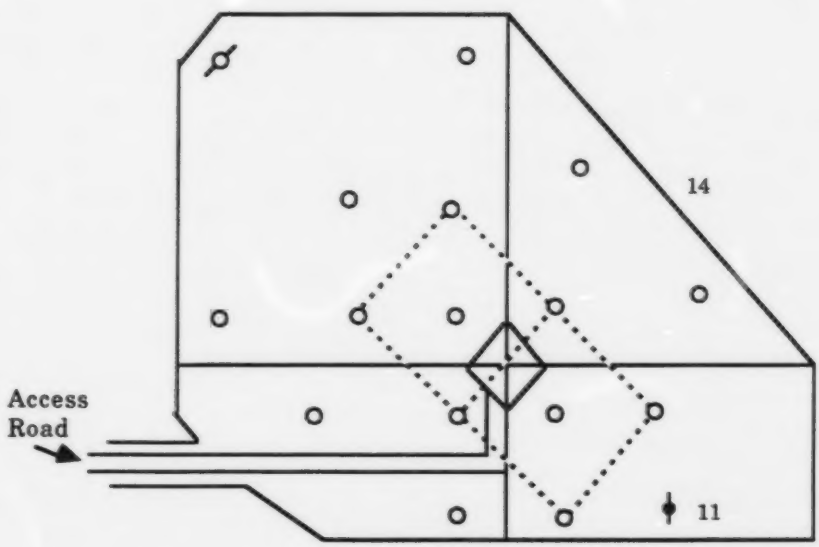
Injection/Production	18
Water disposal	1

FACILITIES

STEAM GENERATOR(S): one - 26 GJ/hr steam generator
ARTIFICIAL LIFT METHODS: Conventional Pump Jacks
TREATER TYPE: Atmospheric
STORAGE FACILITIES: Tanks
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	Clearwater
Depth to Top of Formation:	375 m.KB
Reservoir Thickness:	
net:	15 m
gross:	40 m
Original Temperature:	15°C
Original Pressure:	2000 kPa
Average Horizontal Permeability:	1500 md
Average Porosity:	30%
Average Water Saturation S_w	30%
Average Oil Saturation S_o	70% pore volume
Oil Viscosity at Reservoir Temp.	500,000 mPa.s
Oil Gravity at Reservoir Temp.	1,000 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator



Gulf Canada Resources Ltd.

Fenn-Big Valley

LOCATION
LSD 2 Section: 23 Township: 35 Range: 20 W4M

PARTNERS:

Gulf Canada Resources Ltd.
AOSTRA

PROCESS: Nitrogen Injection
COST: $1.6 MM (est.)
START-UP: July 16, 1987
TERMINATION: September 1988 (nitrogen injection)

DESCRIPTION

PILOT AREA: Approximately 30 ha
WELL PATTERN:

The Experimental Scheme is planned and directed toward field testing of two processes never before applied in Alberta:

(a) improved recovery of oil, NGL's and sulphur from a Devonian carbonate reef with nitrogen.

(b) control of fluid interfaces within a Devonian carbonate reef by the injection of nitrogen to optimize oil recovery by an immiscible process.

WELL SPACING: 16 ha
NO. OF WELLS:

Injection	1
Production	1

FACILITIES

STEAM GENERATOR(S): N/A
ARTIFICIAL LIFT METHODS: Bottom hole pump until 88-02, flowing thereafter
TREATER TYPE: None (Wellhead Separator)
STORAGE FACILITIES: N/A
TRANSPORT: Satellite gathering system.

RESERVOIR

Geological Horizon:	Leduc (D-3)
Depth to Top of Formation:	1644.1 m.KB
Reservoir Thickness:	
net:	3.81 m
gross:	4.00 m
Original Temperature:	59°C
Original Pressure:	12,510 kPa
Average Horizontal Permeability:	800 (est.) md
Average Porosity:	8.5%
Average Water Saturation S_w	15%
Average Oil Saturation S_o	85% pore volume
Oil Viscosity at Reservoir Temp.	0.8 mPa.s
Oil Gravity at Reservoir Temp.	876 Kg/m^3
Primary Production Rates:	9.0 m^3/well/day
Source:	ERCB ST87-18 and Gulf

Home Oil Company Ltd.

Lloydminster (Kitscoty)

LOCATION
LSD 2,3,4 Section: 2 Township: 51 Range: 2 W4M

PARTNERS:

Esso Canada Resources Ltd.
17.5%
Home Oil Company Ltd.
82.5%

PROCESS: Cyclic Steam and Steamflood
COST:
Capital - 9 x 10^6 or $10,000,000 for Phase I, II and III (5 new wells were drilled in 1988 and an existing well was tied to the project).
Operating - N/A
START-UP: 1981
TERMINATION: 1992

DESCRIPTION

WELL PATTERN: One five spot and two six spot and 2 single Huff and Puff wells

WELL SPACING: 2 ha

NO. OF WELLS:
All 15 wells are still on cyclic.

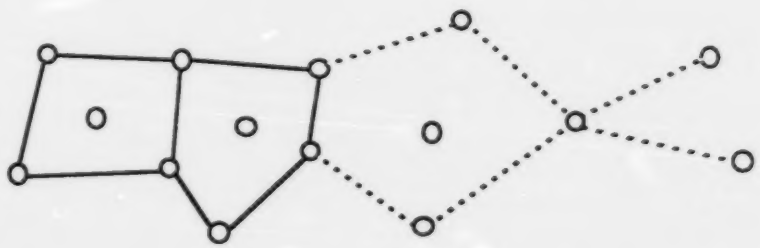
FACILITIES

STEAM GENERATOR(S): one - 26.37 GJ/hr steam generator
STORAGE FACILITIES: Tanks
TRANSPORT: Trucks

RESERVOIR

Geological Horizon:	Sparky Sand
Depth to Top of Formation:	570 m.KB
Reservoir Thickness:	
net:	19 m
gross:	26 m
Original Temperature:	15°C
Original Pressure:	3400 kPa
Average Horizontal Permeability:	2000-3000 md
Average Porosity:	30%
Average Water Saturation S_w	20%
Average Oil Saturation S_o	80% pore volume
Oil Viscosity at Reservoir Temp.	8000 mPa.s
Oil Gravity at Reservoir Temp.	985 Kg/m^3
Primary Production Rates:	5 m^3/well/day
Source:	Pilot Operator

COMMENTS:
Home Oil drilled 5 new wells in 1988 and tied an existing well to the project.



Husky Oil Ltd.

Caribou Lake Pilot Project

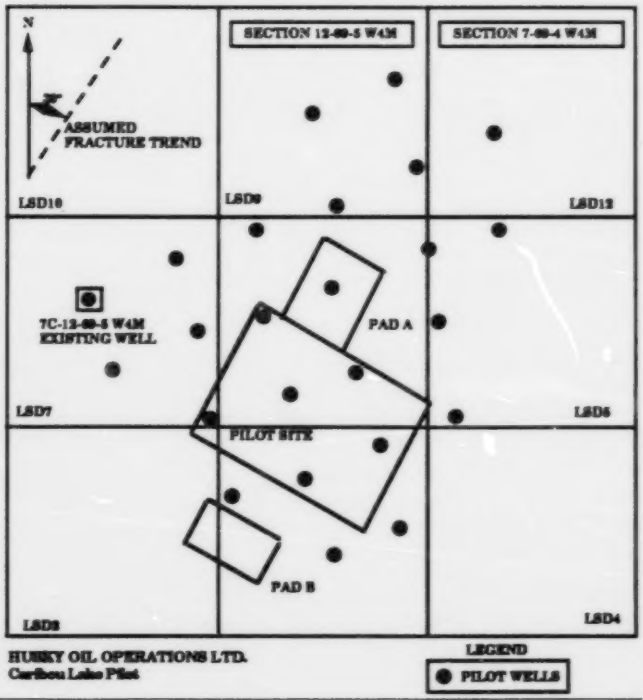
LOCATION
LSD ___ Section: 12 Township: 69 Range: 5 W4M
PARTNERS:
Husky Oil Ltd.
AEC Oil & Gas Company
PROCESS: Cyclic Steam Stimulation
COST: $20 Million
START-UP: December 1990
TERMINATION: Ongoing

DESCRIPTION

PILOT AREA: 40 ha
WELL PATTERN: elongated, inverted 7-spot
WELL SPACING: 1.6 ha/well
NO. OF WELLS: 25 injection/production wells

FACILITIES

STEAM GENERATOR(S): 1-50 MMBTU/hr
1-25 MMBTU/hr
ARTIFICIAL LIFT METHODS: Conventional Pump Jacks
TREATER TYPE: Horizontal, 3 phase, electrostatic
STORAGE FACILITIES: Lease Tanks
TRANSPORT: Trucking



RESERVOIR

Geological Horizon:	Clearwater B
Depth to Top of Formation:	450 m.KB
Reservoir Thickness:	
net:	22 m
gross:	25 m
Original Temperature:	16°C
Original Pressure:	2800 kPa
Average Horizontal Permeability:	1500 md
Average Porosity:	33%
Average Water Saturation S_w	40%
Average Oil Saturation S_o	60% pore volume
Oil Viscosity at Reservoir Temp.	33,000-69,000 mPa.s
Oil Gravity at Reservoir Temp.	990 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator

COMMENTS: Husky Oil Ltd. and AEC Oil & Gas Company announced their intention to proceed with the development of the Caribou Lake Pilot Project, located in Township 69, Range 5 @4M, in the Cold Lake Air Weapons Range. This project will test the potential commercial application of producing heavy oil using cyclic steaming technology. Husky will operte the project and has a 60% working interest. AEC Oil & Gas Company, A Division of Alberta Energy Company Ltd., has a 40% working interest in the project.

Husky and AEC have drilled 48 exploratory and development wells on the 372-section Caribou Lake block. Natural gas and bitumen discoveries have resulted, with the quality and extent of the bitumen resources justifying this pilot recovery project.

Site clearing and preparation is to start immediately with well drilling to follow after freeze-up and the main facility construction to occur through the second and third quarters of 1990, followed by start-up prior to year-end. The pilot will consist of 25 cyclic steam/production wells, 75 MMBTU/hour steam generation capacity and associated oil treating and produced water clarification facilities. A comprehensive testing and analysis program to define technology for maximum reuse of produced water will be incorporated. Total capital cost of the Pilot is expected to be approximately $20 million.

Husky Oil Operations Ltd.

Kearl Lake

LOCATION

LSD ___ Section: 9,10,15,16 Township: 95 Range: 7 W4M

PARTNERS:

*Husky Oil Operations Ltd.	38.25%
Esso Resources Canada Limited	36.75%
AOSTRA	25%

* Husky Oil Operations Ltd. acts as agent for Canterra Energy Ltd.

PROCESS: Modified Steam Drive
COST:
Capital - $54,000,000
Operating - $73,000,000
START-UP: 1981
TERMINATION: n/a

RESERVOIR

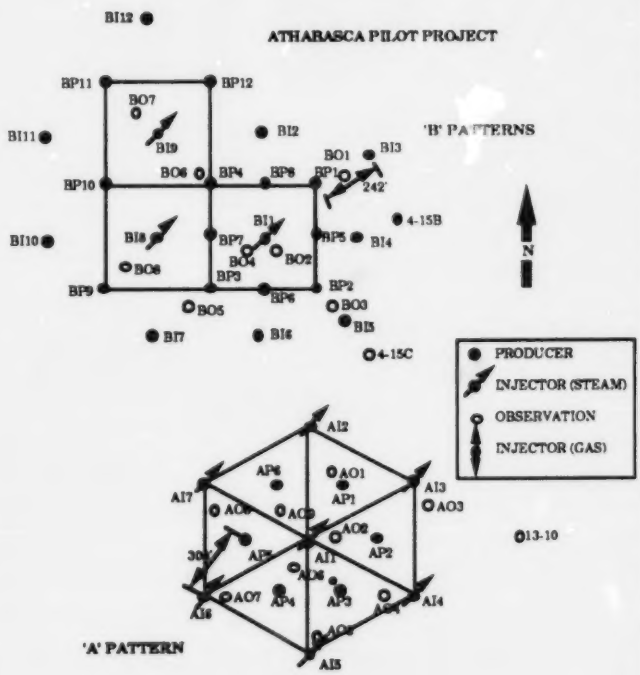
Producing Formation:	McMurray
Depth to Top of Formation:	150 m.KB
Reservoir Thickness:	
net:	40 m
gross:	75 m
Original Temperature:	10°C
Original Pressure:	800 kPa
Average Horizontal Permeability:	2000-6000 md
Average Porosity:	32%
Average Water Saturation	24%
Average Oil Saturation	76%
Oil Viscosity at Reservoir Temp.	2.0 x 10^6 mPa.s
Oil Gravity at Reservoir Temp.	1014 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator

DESCRIPTION

PILOT AREA: "A" Pattern 6.4 ha; B Pattern 3.24 ha
WELL PATTERN:

WELL SPACING: "A" Pattern 0.71 ha; BI1 Pattern 0.27 ha; BI8 & BI9 Patterns 0.54 ha.
NO. OF WELLS:

	"A" Pattern	"B" Pattern
Injection (steam)	7 (7 suspended)	3
Production	6 (3 suspended)	12
Observation	9 (3 suspended)	14



FACILITIES

STEAM GENERATORS: Three 53 GJ/hr steam generator
ARTIFICIAL LIFT METHODS: Conventional rod insert pumps.
TREATER TYPE: Field separators and pressure treaters at central facility.
STORAGE FACILITIES: Heated tanks.
TRANSPORT: Trucks.

Koch Exploration Canada Ltd.

Fort Kent

LOCATION
LSD 11 Section: 19 Township: 61 Range: 4 W4M

PARTNERS:

Koch Exploration Canada Ltd.	100%

PROCESS: Cyclic Steam Stimulation
COST: N/A
START-UP: December 13, 1985
TERMINATION: N/A

DESCRIPTION

PILOT AREA: 65 ha
WELL SPACING: 2.02 ha
NO. OF WELLS:

Injection/Production (slant)	13
Water Disposal Well	1
Water Source Well	1

FACILITIES

STEAM GENERATOR(S): one - 31.65 GJ/hr steam generator
ARTIFICIAL LIFT METHODS: Bottom Hole Pump
TREATER TYPE: FWKO & Electrostatic Treater
STORAGE FACILITIES: Tanks
TRANSPORT: Husky Pipeline to Lloydminster

RESERVOIR

Geological Horizon:	Upper Grand Rapids
Depth to Top of Formation:	345 m.KB
Reservoir Thickness:	
net:	15 m
gross:	17 m
Original Temperature:	21°C
Original Pressure:	3500 kPa
Average Horizontal Permeability:	2000 md
Average Porosity:	35%
Average Water Saturation S_w	30%
Average Oil Saturation S_o	70% pore volume
Oil Viscosity at Reservoir Temp.	30,000 mPa.s
Oil Gravity at Reservoir Temp.	992 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator

Mazzei Oil & Gas Ltd.

Frog Lake

LOCATION
Section: 15 Township. 56 Range: 3 W4M

PARTNERS:

Mazzei Oil & Gas Ltd.	100%

PROCESS: Compare Huff and Puff Steam to Electromagnetic
COST: $1 Million
START-UP: February 1, 1990
TERMINATION: March 1993

DESCRIPTION

PILOT AREA: Frog Lake
WELL PATTERN:
WELL SPACING: 40 acre
NO. OF WELLS: 4 wells being tested 2 Steam and 2 Electromagnetic

FACILITIES

STEAM GENERATOR(S): 25 mill steam generator
ARTIFICIAL LIFT METHODS: Tubing Pump
TREATER TYPE:
STORAGE FACILITIES:
TRANSPORT: Truck oil to Murphy Blackfoot

RESERVOIR

Geological Horizon:	G.P. and Sparky Zones
Depth to Top of Formation:	457 m.KB
Reservoir Thickness:	
net:	3.0 m
gross:	3.5 m
Original Temperature:	25°C
Original Pressure:	kPa
Average Horizontal Permeability:	md
Average Porosity:	33%
Average Water Saturation S_w	15%
Average Oil Saturation S_o	% pore volume
Oil Viscosity at Reservoir Temp.	mPa.s
Oil Gravity at Reservoir Temp.	10 Kg/m^3
Primary Production Rates:	7 m^3/well/day
Source:	Pilot Operator

COMMENTS: First cycle of steam requires 2000 m^3 slug. Second cycles requires 3000 m^3 slug.

Mobil Oil Canada, Ltd.

Iron River Pilot

LOCATION
LSD 11, 12, 13, 14 Section: 6 Township: 64 Range: 4 W4M
PARTNERS:
Mobil Oil Canada, Ltd. 100%
PROCESS: Cyclic Steam Stimulation
COST: $14 Million
START-UP: March 15, 1988
TERMINATION: Approval Expires April 30, 1992

DESCRIPTION

PILOT AREA: 160 acres
WELL PATTERN: See diagram
WELL SPACING: 4 acre; 8 acre
NO. OF WELLS:

Injectors/Producers	23
Observation Wells	3

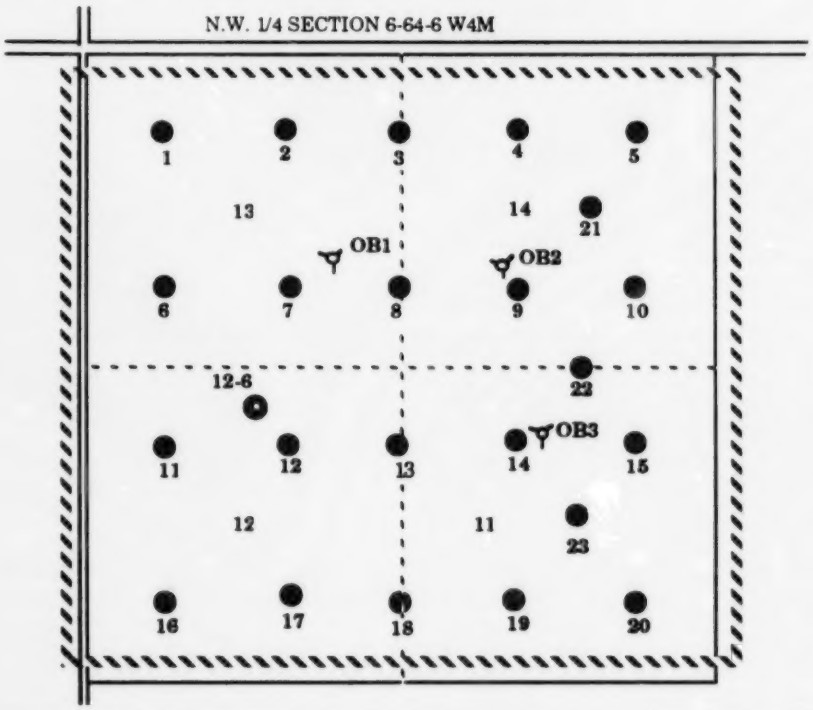
FACILITIES

STEAM GENERATOR(S): two - 26 GJ/hr steam generator
ARTIFICIAL LIFT METHODS: Slant and Conventional Pump Jacks, progressive cavity pumps, chamber pumps

TREATER TYPE: Production flowlined to nearby Iron River Battery, with on site treating and water disposal employing a pressure treater.
STORAGE FACILITIES:
TRANSPORT: Clean oil is trucked to Husky Tucker Lake terminal.

RESERVOIR

Geological Horizon:	Lower Grand Rapids (Sparky)
Depth to Top of Formation:	360 m.KB
Reservoir Thickness:	
net:	19 m
gross:	27 m
Original Temperature:	15°C
Original Pressure:	3000 kPa
Average Horizontal Permeability:	500-2000 md
Average Porosity:	35%
Average Water Saturation S_w	35%
Average Oil Saturation S_o	65% pore volume
Oil Viscosity at Reservoir Temp.	50,000 mPa.s
Oil Gravity at Reservoir Temp.	988 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator



Mobil Oil Canada, Ltd.

Kitscoty

LOCATION
LSD ___ Section: 7, 18, 12, 13 & 14 Township: 51
Range: 2 W4M
PARTNERS:
Mobil Oil Canada, Ltd.
Norcen Energy Resources Ltd.
Home Oil Company Ltd.
PROCESS: Thermal drive with water slug.
COST: N/A
START-UP: September 1975
TERMINATION: December1988

DESCRIPTION

PILOT AREA: 420.9 ha
WELL PATTERN: Inverted 7-Spots
WELL SPACING: 4.05 ha
NO. OF WELLS:

Injection	7
Production	84
Observation	2

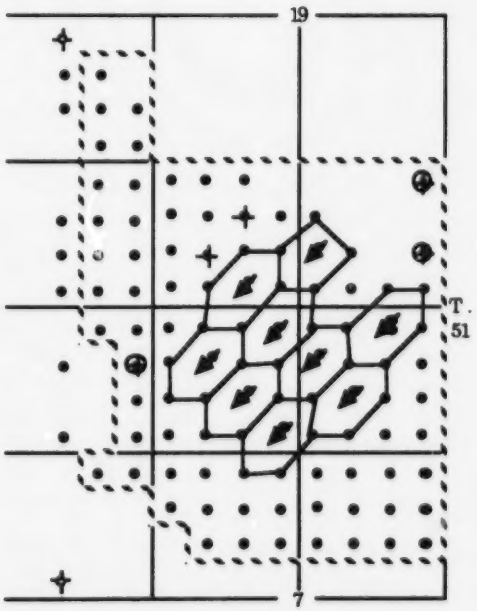
FACILITIES

STEAM GENERATOR(S): one air compressor 90.6 x 10^3 m^3/d @ 6.895 MPa

ARTIFICIAL LIFT METHODS: Standard Pump Jacks with some Griffin downhole pumps.
TREATER TYPE: Pressure Treater
STORAGE FACILITIES: Lease tanks and central treating receiving tanks.
TRANSPORT: Husky Pipeline

RESERVOIR

Geological Horizon:	Sparky Sand
Depth to Top of Formation:	548 m.KB
Reservoir Thickness:	
net:	5 m
gross:	m
Original Temperature:	21°C
Original Pressure:	3450 kPa
Average Horizontal Permeability:	2000 md
Average Porosity:	34%
Average Water Saturation S_w	15%
Average Oil Saturation S_o	85% pore volume
Oil Viscosity at Res. Temp.	15,000-40,000 mPa.s
Oil Gravity at Reservoir Temp.	985 Kg/m^3
Primary Production Rates:	1-2 m^3/well/day
Source:	Pilot Operator



Mobil Oil Canada, Ltd.

Wolf Lake

LOCATION

LSD ___ Section: 5, 6, 7, 8 Township: 64 Range: 6 W4M Also: 21, 27-64-6, 12-64-7, 31, 32-63-6 and 36-63-7

PARTNERS:

Mobil Oil Canada, Ltd.	100%

PROCESS: Cyclic Steam Stimulation
COST: N/A
START-UP: May 1982; Several tests added
TERMINATION:

DESCRIPTION

PILOT AREA: Widely spaced wells.
WELL PATTERN: Individual well steam stimulations
NO. OF WELLS:

Injection/Production	15
Observation	1

(Nine wells currently suspended.)

FACILITIES

STEAM GENERATOR(S): one portable 26 GJ/hr
ARTIFICIAL LIFT METHODS: Conventional tubing pumps.
TREATER TYPE: Produced to wellhead tanks and trucked to recently completed on-site treating and water disposal facilities employing a pressure treater. Clean oil is trucked to the Husky sales terminal at Tucker
STORAGE FACILITIES:
TRANSPORT: Trucked

RESERVOIR

Geological Horizon:	Upper & Lower Grand Rapids
Depth to Top of Formation:	UGR 310-350 m.KB LGR 340-380 m.KB
Reservoir Thickness:	
net:	UGR 0-10 m LGR 10-30 m
gross:	UGR 20-60 m LGR 60-80 m
Original Temperature:	15°C
Original Pressure:	3200 kPa
Average Horizontal Permeability:	1000-4000 md
Average Porosity:	35%
Average Water Saturation S_w	38%
Average Oil Saturation S_o	62% pore volume
Oil Viscosity at Res. Temp.	20,000-100,000 mPa.s
Oil Gravity at Reservoir Temp.	1000-986 Kg/m^3 (10-12°API)
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator

Mobil Oil Canada, Ltd.

Wolf Lake Extension

LOCATION
LSD 11 Section: 17 Township: 64 Range: 6 W4M
PARTNERS:
Mobil Oil Canada, Ltd. 100%
PROCESS: Horizontal well-steam stimulated
COST: N/A
START-UP: June 15, 1989
TERMINATION:

DESCRIPTION

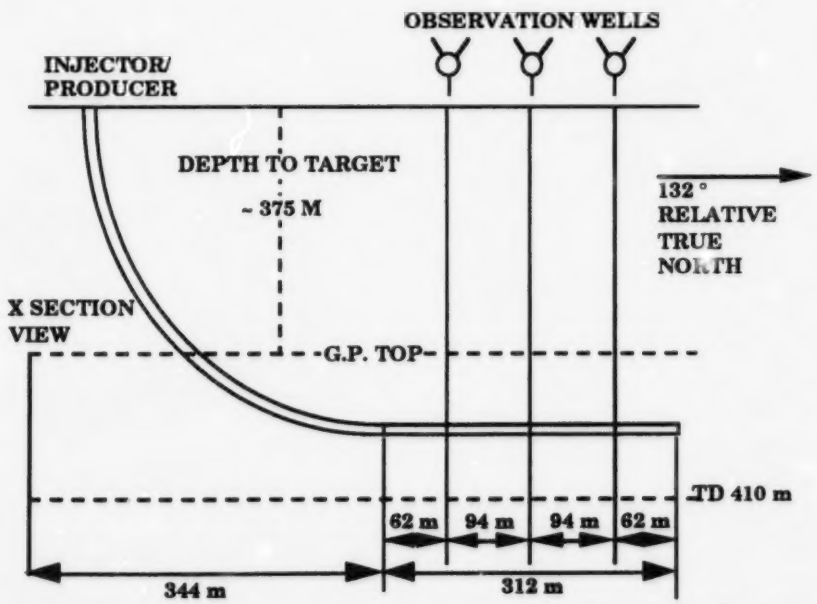
Horizontal well - steam stimulated - with 3 vertical temperature observation wells.
PILOT AREA: ~3 ha
WELL PATTERN: single horizontal well - 300 m
WELL SPACING: n/a
NO. OF WELLS: 4-1 horizontal, 3 vertical

FACILITIES

STEAM GENERATOR(S): 1 - 26 GJ/hr
ARTIFICIAL LIFT METHODS: steam circulation/beam pump
TREATER TYPE: Atmospheric gravity segregation on-site.
STORAGE FACILITIES: 6 - tanks (120 m^3) on site
TRANSPORT: Trucked to Iron River Facility for treating prior to trucking to Husky Tucker Lake terminal.

RESERVOIR

Geological Horizon:	Lower Grand Rapids - G.P.
Depth to Top of Formation:	375 m
Reservoir Thickness:	
net:	12 m
gross:	17 m
Original Temperature:	15°C
Original Pressure:	3000 kPa
Average Horizontal Permeability:	3 Darcies
Average Porosity:	35%
Average Water Saturation S_w	25%
Average Oil Saturation S_o	75% pore volume
Oil Viscosity at Res. Temp.	100,000 mPa.s
Oil Gravity at Reservoir Temp.	997 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator



Murphy Oil Company Ltd.

Lindbergh

LOCATION
LSD 6 Section: 13 Township: 58 Range: 5 W4M
PARTNERS:

Murphy Oil Company Ltd.	100%

PROCESS: Cyclic Steam Stimulation
COST:
Capital - $7 MM
Operating - $2.5 MM/Yr.
START-UP: 1974
TERMINATION: Partially Suspended

DESCRIPTION

PILOT AREA: 20.23 ha
WELL PATTERN: Elongated 7-Spot
WELL SPACING: 2.02 ha
NO. OF WELLS:

Injection/Production	16
Observation	0

FACILITIES

STEAM GENERATOR(S): one - 21 GJ/hr steam generator and one - 53 GJ/hr steam generator
ARTIFICIAL LIFT METHODS: Insert Pumps
TREATER TYPE: Murphy Evaporation Dehydrator
STORAGE FACILITIES: Tied into commercial expansion.
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	Lower Grand Rapids
Depth to Top of Formation:	510 m.KB
Reservoir Thickness:	
net:	20 m
gross:	20 m
Original Temperature:	21°C
Original Pressure:	2700 kPa
Average Horizontal Permeability:	2500 md
Average Porosity:	33%
Average Water Saturation S_w	18%
Average Oil Saturation S_o	82% pore volume
Oil Viscosity at Reservoir Temp.	100,000 mPa.s
Oil Gravity at Reservoir Temp.	990 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator

Murphy Oil Company Ltd.

Morgan

LOCATION
LSD 11 Section: 2 Township: 52 Range: 4 W4M
PARTNERS:

Murphy Oil Company Ltd.	100%

PROCESS: Cyclic Steam Stimulation
COST: Operating - $0.2 MM/Yr.
START-UP: September 1985
TERMINATION:

DESCRIPTION

PILOT AREA: 4 ha
WELL PATTERN: Single Well
WELL SPACING:
NO. OF WELLS:

Injection	1
Production	1
Observation	0

FACILITIES

STEAM GENERATOR(S): Portable Rental
ARTIFICIAL LIFT METHODS: Insert Pump
TREATER TYPE: None
STORAGE FACILITIES: 2 x 120 m^3
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	Lloydminster A
Depth to Top of Formation:	574 m.KB
Reservoir Thickness:	
net:	13 m
gross:	13 m
Original Temperature:	21°C
Original Pressure:	3450 kPa
Average Horizontal Permeability:	1800 md
Average Porosity:	33%
Average Water Saturation S_w	30%
Average Oil Saturation S_o	70% pore volume
Oil Viscosity at Reservoir Temp.	14,500 mPa.s
Oil Gravity at Reservoir Temp.	994 Kg/m^3
Primary Production Rates:	1.75 m^3/well/day
Source:	Pilot Operator

Norcen Energy Resources Ltd.

Lindbergh I

LOCATION

LSD 3,4,6,9,16 Section: 13 Township: 55 Range: 6 W4M
LSD 16 Section: 21 Township: 55 Range: 6 W4M
LSD 10 Section: 15 Township: 55 Range: 5 W4M
LSD 06 Section: 21 Township: 55 Range: 5 W4M
LSD 10 Section: 01 Township: 55 Range: 6 W4M
LSD 10 Section: 15 Township: 56 Range: 6 W4M
LSD 14 Section: 01 Township: 56 Range: 6 W4M
LSD 7 Section: 27 Township: 55 Range: 6 W4M
LSD 2 Section: 35 Township: 55 Range: 6 W4M

PARTNERS:

Norcen Energy Resources Ltd.	100%

PROCESS: Cyclic Huff & Puff
COST: $7,300,000
START-UP: May 1982
TERMINATION: Continuing

DESCRIPTION

PILOT AREA: 178 ha
WELL PATTERN: Single Well
WELL SPACING: 16 ha
NO. OF WELLS:

Injection/Production	13
Observation	0

FACILITIES

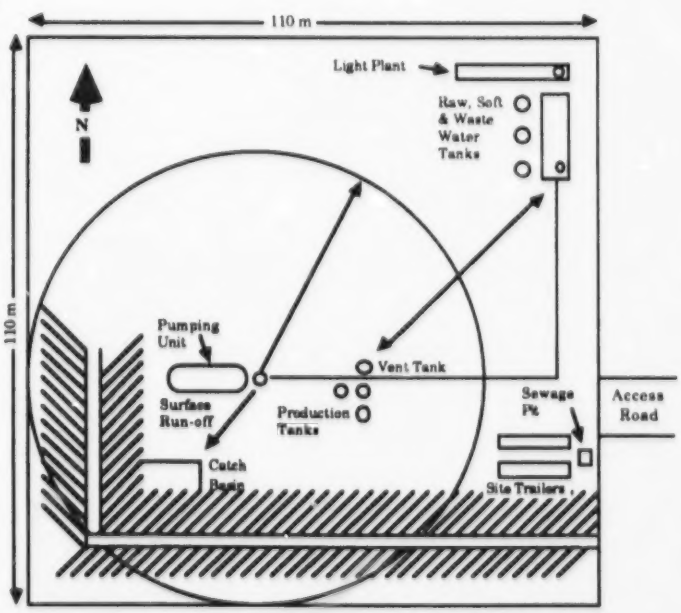
STEAM GENERATOR(S): two - 23.2 GJ/hr steam generators

ARTIFICIAL LIFT METHODS: Conventional Tubing Pump and Pump Jack System
TREATER TYPE: H.T.I.
STORAGE FACILITIES: 3 - 119 m^3 Tanks/Well
TRANSPORT: Trucked to Westmin Cleaning Plant and shipped via Husky pipeline to Lloydminster.

RESERVOIR

Geological Horizon:	Cummings
Depth to Top of Formation:	600 m.KB
Reservoir Thickness:	
net:	12.6 m
gross:	15.0 m
Original Temperature:	24°C
Original Pressure:	3900 kPa
Average Horizontal Permeability:	2400 md
Average Porosity:	30%
Average Water Saturation S_w	20%
Average Oil Saturation S_o	80% pore volume
Oil Viscosity at Reservoir Temp.	9800 mPa.s
Oil Gravity at Reservoir Temp.	986 Kg/m^3
Primary Production Rates:	5.0 m^3/well/day
Source:	Pilot Operator

COMMENTS: Experimental Operations Continuing at all locations.



Norcen Energy Resources Ltd.

Lindbergh II

LOCATION
LSD 1,2,7,8 Section: 13 Township: 55 Range: 6 W4M
PARTNERS:
Norcen Energy Resources Ltd. 100%
PROCESS: Cyclic Steam Stimulation
COST: Capital -$7,500,000
START-UP: October 1984
TERMINATION: Continuing

DESCRIPTION

PILOT AREA: 64.6 ha
WELL PATTERN: 9-Spot
WELL SPACING: 4.05 ha
NO. OF WELLS:

Injection/Production	16
Observation	0

FACILITIES

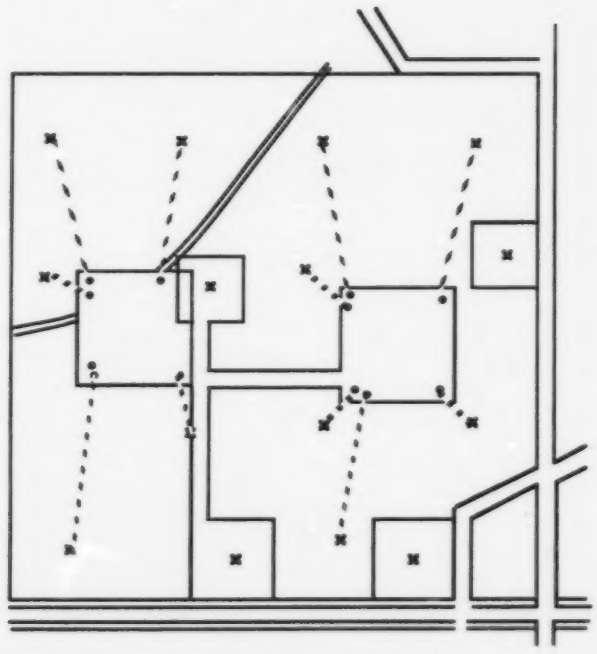
STEAM GENERATOR(S): one - 52.75 GJ/hr steam generator
ARTIFICIAL LIFT METHODS: Conventional Tubing Pump and Pump Jack System
TREATER TYPE: H.T.I. Pump Jack System

STORAGE FACILITIES: two - 150 m^3 tanks
TRANSPORT: Pipeline

RESERVOIR

Geological Horizon:	Cummings
Depth to Top of Formation:	600 m.KB
Reservoir Thickness:	
net:	13.12 m
gross:	15 m
Original Temperature:	24°C
Original Pressure:	3900 kPa
Average Horizontal Permeability:	2838 md
Average Porosity:	25.2%
Average Water Saturation S_w	19.9%
Average Oil Saturation S_o	80.1% pore volume
Oil Viscosity at Reservoir Temp.	9800 mPa.s
Oil Gravity at Reservoir Temp.	986 Kg/m^3
Primary Production Rates:	6.0 m^3/well/day
Source:	Pilot Operator

COMMENTS:
Commissioning of steam generator in May, 1987 with steam injection commenced in June 1987. 13 wells steamed to date.



Norcen Energy Resources Ltd.

Lindbergh III

LOCATION

LSD 11,12,13,14 Section: 13 Township: 55 Range: 6 W4M

PARTNERS:

Norcen Energy Resources Ltd.	100%

PROCESS: Modified Steam Drive
COST: Capital -$6,000,000
START-UP: December 1985
TERMINATION: Continuing

DESCRIPTION

PILOT AREA: 64.6 ha
WELL PATTERN: Inverted 9-Spot with Production Control Wells
WELL SPACING: 4.02 ha/well
NO. OF WELLS:

Injection	1
Production	15
Observation	2

FACILITIES

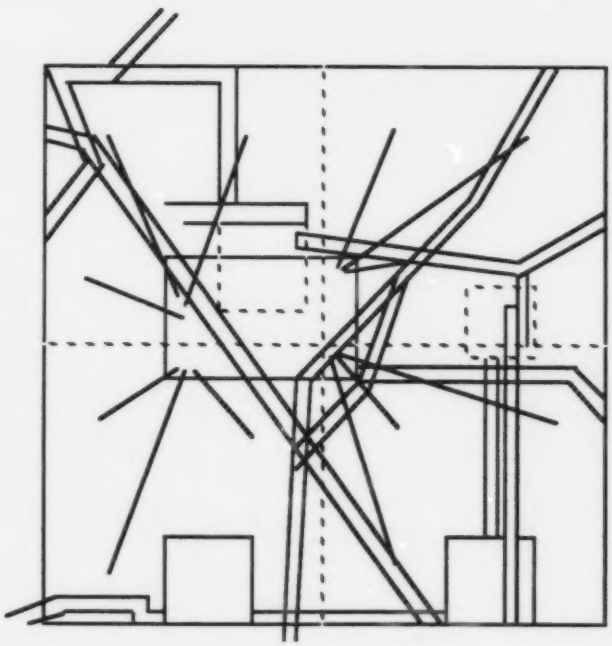
STEAM GENERATOR(S): one - 23.2 GJ/hr steam generator
ARTIFICIAL LIFT METHODS: Conventional tubing and pump and pump jack system and progressive cavity pump system.

TREATER TYPE: H.T.I.
STORAGE FACILITIES: 15 - 119 m^3 tanks
TRANSPORT: Trucked to Westmin cleaning plant and shped via Husky pipeline to Lloydminster.

RESERVOIR

Geological Horizon:	Cummings
Depth to Top of Formation:	600 m.KB
Reservoir Thickness:	
net:	7.31 m
gross:	7.31 m
Original Temperature:	24°C
Original Pressure:	3200 kPa
Average Horizontal Permeability:	3230 md
Average Porosity:	24.7%
Average Water Saturation S_w	20.9%
Average Oil Saturation S_o	79.1% pore volume
Oil Viscosity at Reservoir Temp.	3750 mPa.s
Oil Gravity at Reservoir Temp.	986 Kg/m^3
Primary Production Rates:	6.0 m^3/well/day
Source:	Pilot Operator

COMMENTS: Steam injection commenced in May, 1986 and operation continuing.



Norcen Energy Resources Ltd.

Lloydminster Horizontal Well

LOCATION
LSD 3, 4, & 5 Section: 36 Township: 50 Range: 2 W4M
PARTNERS:
Norcen Energy Resources Ltd.
PROCESS: Horizontal primary production
COST: n/a
START-UP: February 1989
TERMINATION: On-going

DESCRIPTION

Lloydminster Horizontal Well - to evaluate productivity improvements and increased recovery of a hozontal well compared to a vertical well.
PILOT AREA: 120 acres special spacing unit (see attached map)
WELL PATTERN: Single well
WELL SPACING: 40 acres
NO. OF WELLS: 1

FACILITIES

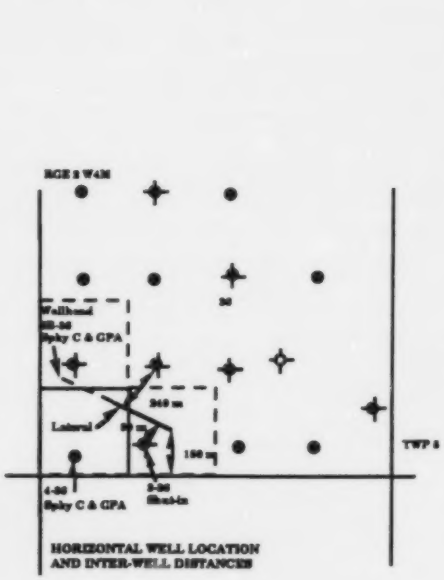
STEAM GENERATOR(S): n/a
ARTIFICIAL LIFT METHODS: Progressive cavity pump
TREATER TYPE: n/a

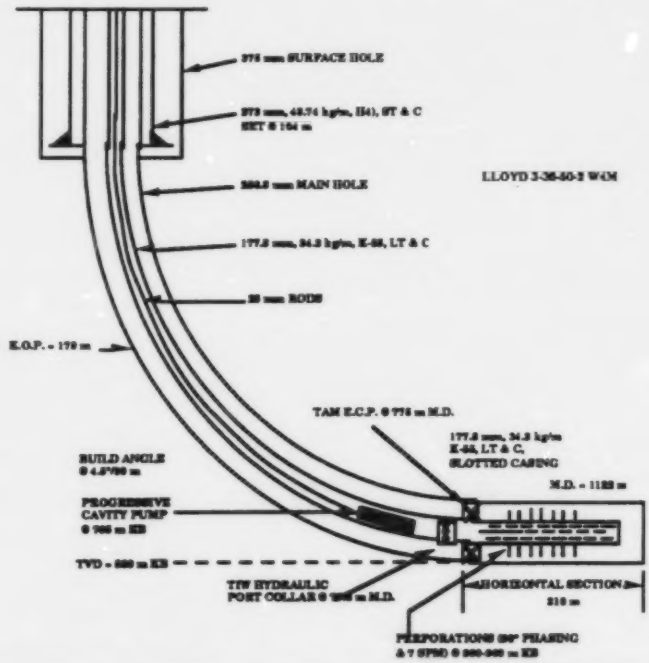
STORAGE FACILITIES: Lease tank
TRANSPORT: Trucked

RESERVOIR

Geological Formation:	Sparky "B"
Depth to Top of Formation:	585 m
Reservoir Thickness:	
net:	7.5 m
gross:	10.4 m
Original Temperature:	20°C
Original Pressure:	3718 kPa
Average Horizontal Permeability:	1-3 Darcies
Average Porosity:	29%
Average Water Saturation S_w	80%
Average Oil Saturation S_o	20%
Live Oil Viscosity at Reservoir Temp.	2270 mPa.s
Oil Gravity at Reservoir Temp.	967 Kg/m^3
Primary Vertical Production Rates:	5.0 m^3/well/day
Source:	Pilot Operator

COMMENTS: Horizontal well was completed in the middle Sparky which has only 6.0 m net pay. Because of completion problems only 200 m out of the total horizontal section of 300 m is open to the formation.





Norcen Energy Resources Ltd.

Provost (BODO)

LOCATION
LSD 5 Section: 20 Township: 37 Range: 1 W4M
PARTNERS:
Norcen Energy Resources Ltd.
Canadian Occidental Petroleum Ltd.
Murphy Oil Company Ltd.
Texaco Canada Resources
AOSTRA
PROCESS: Cyclic Steam Stimulation followed by Steamflood.
COST:
Capital - $14 MM
Operating - $2.5 MM/Yr.
START-UP: February 1985
TERMINATION: 1992

DESCRIPTION

PILOT AREA: 8 ha
WELL PATTERN: Single Inverted Nine-Spot Pattern.
NO. OF WELLS:

Injection	1
Production	8
Observation	3

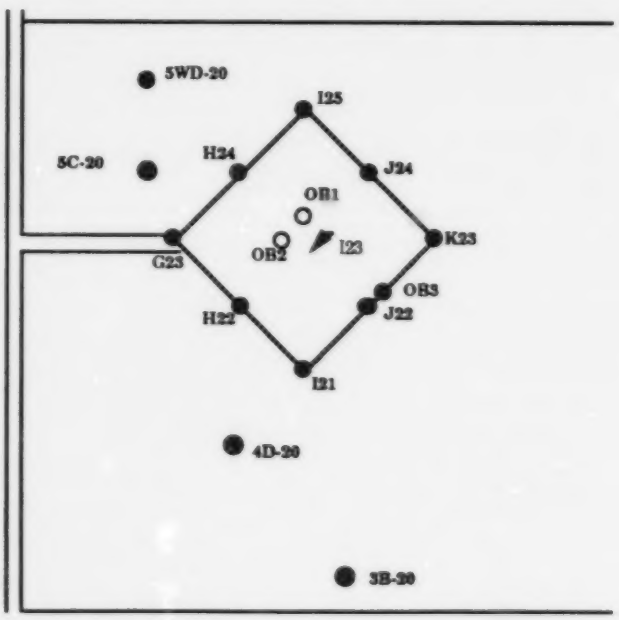
FACILITIES

STEAM GENERATOR(S): one - 26 GJ/hr steam generator

ARTIFICIAL LIFT METHODS: Five HEP Pumping Units and three Le Grand 456 Conventional Pumping Unit.
TREATER TYPE: Complete tank farm and battery with distillation/evaporation type treator.
TRANSPORT: Pipeline to Sales

RESERVOIR

Geological Formation:	McLaren Sand of the Upper Mannville Group
Depth to Top of Formation:	720 m.KB
Reservoir Thickness:	
net:	15 m
gross:	up to 24 m
Original Temperature:	27°C
Original Pressure:	5450 kPa
Average Horizontal Permeability:	1000-5000 md
Average Porosity:	30%
Average Water Saturation S_w	20%
Average Oil Saturation S_o	80%
Oil Viscosity at Reservoir Temp.	2300 mPa.s
Oil Gravity at Reservoir Temp.	979 Kg/m^3
Primary Production Rates:	4-5 m^3/well/day
Source:	Pilot Operator



PanCanadian Petroleum Ltd.

Countess B

LOCATION

LSD ___ Section: 16 Township: 29 Range: 16 W4M

PARTNERS:

PanCanadian Petroleum Ltd.	50%
LL&E	50%

Relative to Licensing Revenue:

PanCanadian Petroleum Ltd.	45%
LL&E	45%
AOSTRA	10%

PROCESS: Combination Thermal Drive

COST:

Capital - $3,900,000 to September 30, 1989

Operating - $4,888,000 to September 30, 1989

START-UP: December 1982

TERMINATION: 1990 (air injection only)

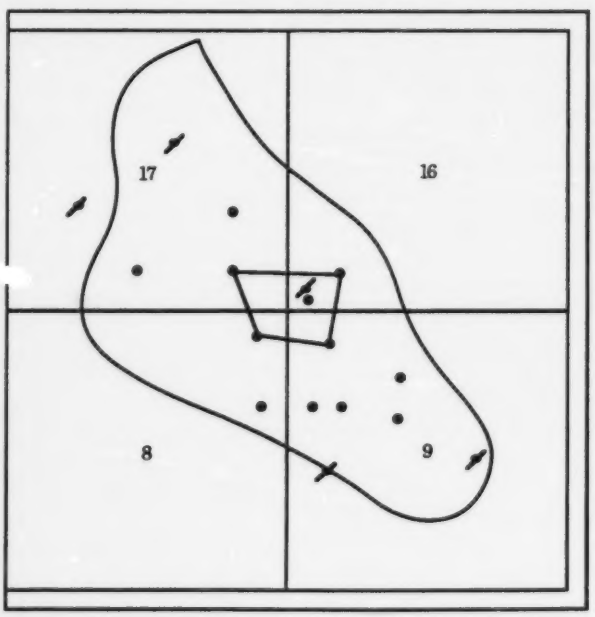
DESCRIPTION

PILOT AREA: 16.3 ha

WELL PATTERN: Inverted 5-Spot

NO. OF WELLS:

Injection	1
Production	4
Observation/Sampling Well	1
Post Combustion Core Well	1



FACILITIES

COMPRESSOR(S): No. - 2 boosters and one main air compressor - Capacity 56,600 m^3/d @ 24.1 MPa

ARTIFICIAL LIFT METHODS: Sucker Rod Pumps

TREATER TYPE: Horizontal Murdoch HOWG

STORAGE FACILITIES: Oil Production and Shipping Tanks.

TRANSPORT: LACT, BRPL

RESERVOIR

Geological Horizon:	Countess Upper Mannville B
Depth to Top of Formation:	1083 m.KB
Reservoir Thickness:	
net:	5.8-10.4 m
gross:	m
Original Temperature:	37°C
Original Pressure:	10,000 kPa
Average Horizontal Permeability:	800 md
Average Porosity:	25%
Average Water Saturation S_w	50%
Average Oil Saturation S_o	50% pore volume
Oil Viscosity at Reservoir Temp.	6 mPa.s
Oil Gravity at Reservoir Temp.	887 Kg/m^3
Primary Production Rates:	12 m^3/well/day
Source:	Pilot Operator

COMMENTS: Air injection continues, but nearing point of conversion to water injection for heat scavenging.

Planning additional 2 patterns and 3 air injectors to south.

Cumulative combustion gas composition to the end of 1989 follows:

Nitrogen	=	73.00%
Carbon Dioxide	=	10.00%
Carbon Monoxide	=	0.24%
Oxygen	=	0.67%

Technically successful.

PanCanadian Petroleum Ltd.

Lindbergh

LOCATION
LSD ___ Section: 07 Township: 55 Range: 5 W4M
LSD ___ Section: 03 Township: 56 Range: 6 W4M

PARTNERS:
PanCanadian Petroleum Ltd. 100%
PROCESS: Cyclic Steam Stimulation
COST:
Capital - $60,000/well (est.)
Operating - $150,000/well/yr.
START-UP: September 1983 (as per Approval No. 3886)
TERMINATION: 1989

DESCRIPTION

PILOT AREA: N/A
WELL PATTERN: N/A
WELL SPACING: 4 ha - 16 ha
NO. OF WELLS:
Injection/Production 18

FACILITIES

STEAM GENERATOR(S): one - 25 MMBtu
ARTIFICIAL LIFT METHODS: Standard steam and heavy oil sucker rod pump.
TREATER TYPE:
STORAGE FACILITIES: Standard stock tanks
TRANSPORT: Truck, LACT Unit

RESERVOIR

Geological Horizon:	Cummings B & C
Depth to Top of Formation:	580 m.KB
Reservoir Thickness:	
net:	9 (Sec. 7) 12 (Sec. 3) m
gross:	12 (Sec. 7) 18 (Sec. 3) m
Original Temperature:	24°C
Original Pressure:	4400 kPa
Average Horizontal Permeability:	1000 md
Average Porosity:	30%
Average Water Saturation S_w	20%
Average Oil Saturation S_o	80% pore volume
Oil Viscosity at Reservoir Temp.	3000 mPa.s
Oil Gravity at Reservoir Temp.	986 Kg/m^3
Primary Prod. Rates:	2 (Sec. 7) m^3/well/day
	6 (Sec. 3) m^3/well/day
Source:	Pilot Operator

PanCanadian Petroleum Ltd.

Lindbergh - Elk Point

LOCATION
LSD 11 Section: 03 Township: 56 Range: 6 W4M
Lindbergh

PARTNERS:
PanCanadian Petroleum Ltd. 100%

PROCESS: Steamflood Pilot
COST:
Capital - $520 M
Operating - $1600/day
START-UP: By May 1990 (as per Approval #6099)
TERMINATION: 1991

DESCRIPTION

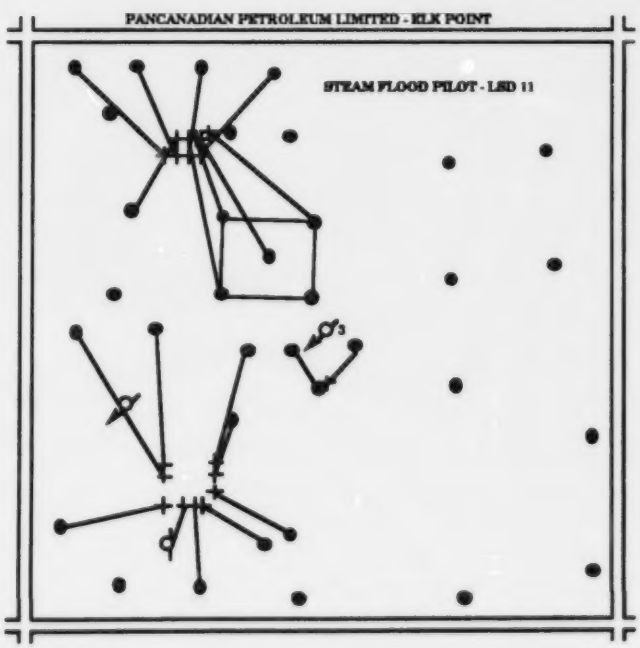
Steamflood Pilot Project application was made to the ERCB in January 1990. Pilot steamflood will be conducted in section 3-56-6W4M
PILOT AREA: 4 ha
WELL PATTERN: inverted 5-spot
WELL SPACING: 4 ha
NO. OF WELLS: 1 injection/4 production

FACILITIES

STEAM GENERATOR(S): one - 25 MMBtu
ARTIFICIAL LIFT METHODS: Screw pump/standard steam and heavy oil sucker rod.
TREATER TYPE:
STORAGE FACILITIES: Standard stock tanks
TRANSPORT: Truck, LACT

RESERVOIR

Geological Horizon:	Cummings B & C
Depth to Top of Formation:	603 m.KB
Reservoir Thickness:	
net:	13 m
gross:	18 m
Original Temperature:	24°C
Original Pressure:	4400 kPa
Average Horizontal Permeability:	1000 md
Average Porosity:	30%
Average Water Saturation S_w	22%
Average Oil Saturation S_o	78% pore volume
Oil Viscosity at Reservoir Temp.	3000 mPa.s
Oil Gravity at Reservoir Temp.	985 Kg/m^3
Primary Prod. Rates:	6 m^3/well/day
Source:	Pilot Operator



Petro-Canada Resources

Hangingstone I

LOCATION
LSD 13 Section: 27 Township: 84 Range: 11 W4M

PARTNERS:

Petro-Canada Resources	25%
Canadian Occidental Petroleum Ltd.	25%
Esso Resources Canada Ltd.	25%
Japan Canada Oil Sands	25%

PROCESS: Cyclic Steam Stimulation
COST: N/A
START-UP: February 1, 1985
TERMINATION: January, 1988

DESCRIPTION

PILOT AREA: Single Well Test

FACILITIES

STEAM GENERATOR(S): one - 26 GJ/hr portable steam generator
ARTIFICIAL LIFT METHODS: Standard Pump Jack
TREATER TYPE: Atmospheric Treating Tank
STORAGE FACILITIES: Tank Farm on Site
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	McMurray
Depth to Top of Formation:	261 m.KB
Reservoir Thickness:	
net:	43 m
gross:	51 m
Original Temperature:	15°C
Original Pressure:	2200 kPa
Average Horizontal Perrneability:	1350 md
Average Porosity:	32%
Average Water Saturation - S_w	17%
Average Oil Saturation S_o	83% pore volume
Oil Viscosity at Reservoir Temp.	800,000 mPa.s
Oil Gravity at Reservoir Temp.	1008 Kg/m^3
Primary Production Rates:	0 m^3/well/day
Source:	Pilot Operator

Petro-Canada Resources

Hangingstone II

LOCATION
LSD 16 Section: 27 Township: 84 Range: 11 W4M

PARTNERS:

Petro-Canada Resources	25%
Canadian Occidental Petroleum Ltd.	25%
Esso Resources Canada Ltd.	25%
JACOS	25%

PROCESS: Cyclic Steam Stimulation
COST: N/A
START-UP: April 1986
TERMINATION: -

DESCRIPTION

PILOT AREA: Single Well Test

FACILITIES

STEAM GENERATOR(S): one - 26 GJ/hr portable steam generator
ARTIFICIAL LIFT METHODS: Standard Pump Jack
TREATER TYPE: Atmospheric Treating Tank
STORAGE FACILITIES: Tank Farm on Site
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	McMurray
Depth to Top of Formation:	261 m.KB
Reservoir Thickness:	
net:	26 m
gross:	51 m
Original Temperature:	15°C
Original Pressure:	2200 kPa
Average Horizontal Permeability:	1350 md
Average Porosity:	32%
Average Water Saturation S_w	17%
Average Oil Saturation S_o	83% pore volume
Oil Viscosity at Reservoir Temp.	800,000 mPa.s
Oil Gravity at Reservoir Temp.	1008 Kg/m^3
Primary Production Rates:	0 m^3/well/day
Source:	Pilot Operator

Petro-Canada Resources

Hangingstone III

LOCATION
LSD 4 Section: 35 Township: 84 Range: 11 W4M

PARTNERS:

Petro-Canada Resources	25%
Canadian Occidental Petroleum Ltd.	25%
Esso Resources Canada Ltd.	25%
Japan Canada Oil Sands	25%

PROCESS: Cyclic Steam Stimulation
COST: N/A
START-UP: February 1, 1985
TERMINATION: -

DESCRIPTION

PILOT AREA: Single Well Test

FACILITIES

STEAM GENERATOR(S): one - 26 GJ/hr portable steam generator
ARTIFICIAL LIFT METHODS: Standard Pump Jack
TREATER TYPE: Atmospheric Treating Tank
STORAGE FACILITIES: Tank Farm on Site
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	McMurray
Depth to Top of Formation:	263 m.KB
Reservoir Thickness:	
net:	17 m
gross:	35 m
Original Temperature:	15°C
Original Pressure:	2200 kPa
Average Horizontal Permeability:	1350 md
Average Porosity:	32%
Average Water Saturation S_w	15%
Average Oil Saturation S_o	85% pore volume
Oil Viscosity at Reservoir Temp.	800,000 mPa.s
Oil Gravity at Reservoir Temp.	1008 Kg/m^3
Primary Production Rates:	0 m^3/well/day
Source:	Pilot Operator

Petro-Canada Resources

PCEJ

LOCATION
LSD 1 Section: 34 Township: 84 Range: 11 W4M

PARTNERS:

Petro-Canada Resources	25%
Canadian Occidental Petroleum Ltd.	25%
Esso Resources Canada Ltd.	25%
Japan Canada Oil Sands	25%

PROCESS: Steam Stimulation
COST: N/A
START-UP: 1990
TERMINATION:

DESCRIPTION

13 well pilot
PILOT AREA:
WELL PATTERN: Inverted 5-Spots
WELL SPACING: 1.6 ha/well
NO. OF WELLS: 13

FACILITIES

ARTIFICIAL LIFT METHODS: Standard Pump Jack
TREATER TYPE:
STORAGE FACILITIES: Tank farm on site
TRANSPORT: Truck

RESERVOIR

Geological Horizon:	McMurray
Depth to Top of Formation:	285 m
Reservoir Thickness:	
net:	27 m
gross:	30 m
Original Temperature:	15°C
Original Pressure:	2200 kPa
Average Horizontal Permeability:	1350 md
Average Porosity:	32%
Average Water Saturation S_w	10%
Average Oil Saturation S_o	90% pore volume
Oil Viscosity at Reservoir Temp.	800,000 mPa.s
Oil Gravity at Reservoir Temp.	1008 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator

COMMENTS: Pilot design not completely finalized at this time.

Petro-Canada Resources

Viking-Kinsella B

LOCATION
LSD 2 Section: 24 Township: 48 Range: 9 W4M

PARTNERS:
Petro-Canada Resources
81.125%
PanCanadian Petroleum Ltd.
16.538%
Dome Petroleum Ltd.
2.337%

PROCESS: Oxygen In Situ Combustion
COST: N/A
START-UP: January 1984
TERMINATION: December 1987

DESCRIPTION

PILOT AREA: 8 ha
WELL PATTERN: Inverted 5-Spot
WELL SPACING: 4 ha
NO. OF WELLS:

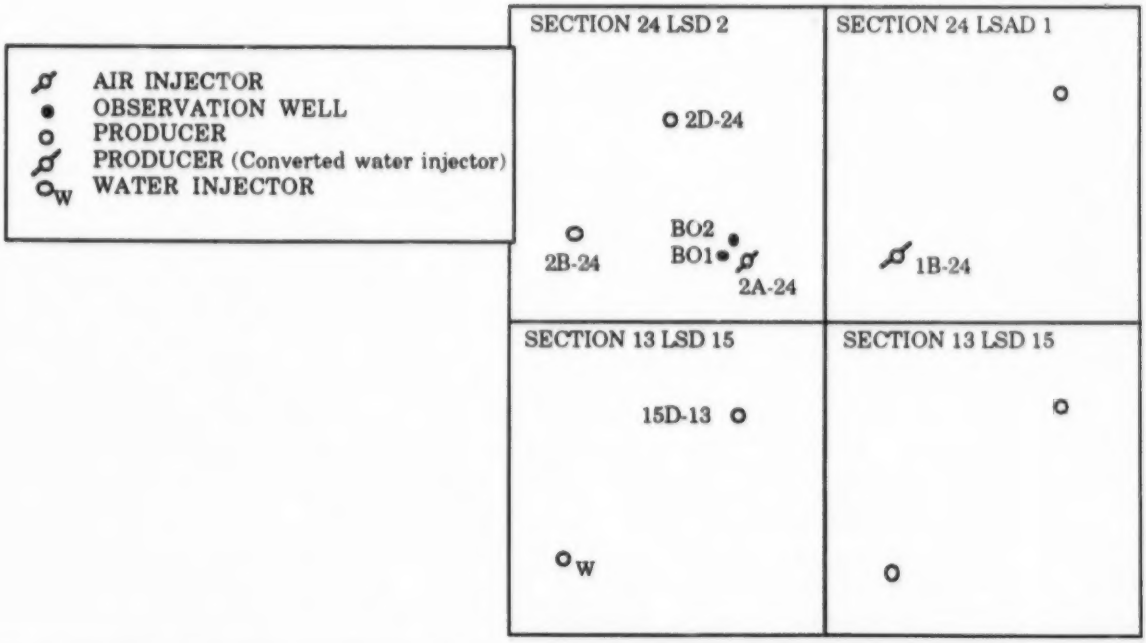
Injection	1
Production	4
Observation	2

FACILITIES

ARTIFICIAL LIFT METHODS: Insert Pumps
TREATER TYPE: Production to existing Kinsella B Battery
STORAGE FACILITIES: Production to existing Kinsella B Battery
TRANSPORT: Battery production shipped via pipeline.

RESERVOIR

Geological Horizon:	Sparky
Depth to Top of Formation:	652 m.KB
Reservoir Thickness:	
net:	4.0 m
gross:	5.0 m
Original Temperature:	28°C
Original Pressure:	5030 kPa
Average Horizontal Permeability:	200 md
Average Porosity:	30%
Average Water Saturation S_W	33%
Average Oil Saturation S_O	67% pore volume
Oil Viscosity at Reservoir Temp.	100 mPa.s
Oil Gravity at Reservoir Temp.	934 Kg/m^3
Primary Production Rates:	nil m^3/well/day
Source:	Pilot Operator



Renaissance Energy Ltd.

Horizontal Well

LOCATION
LSD 11B Section: 21 Township: 20 Range: 8 W4M
PARTNERS:
Renaissance
100%

PROCESS: Horizontal Well
COST: Approximately $500,000
START-UP: June 1989
TERMINATION: January 31, 1994

DESCRIPTION

300 m long horizontal well drilled within 4 m of the top of the Glauc sand, and approximately 12 m above oil/water contact
PILOT AREA:
WELL PATTERN: Standard 10 acre spacing
WELL SPACING: 10 acres
NO. OF WELLS: Two horizontal wells both approximately 300 m long one 10 acre producer in 11B-21

FACILITIES

STEAM GENERATOR(S): n/a
ARTIFICIAL LIFT METHODS: High volume rotary pumps
TREATER TYPE: Well is tied into Renaissance Battery at 6-21-20-8 W4M
STORAGE FACILITIES: Standard conventional oil storage and treating facilities
TRANSPORT: Tied into Bow Island Pipeline system

RESERVOIR

Geological Horizon:	Upper Mannville
Depth to Top of Formation:	918.6 m.KB
Reservoir Thickness:	
net:	16.0 m
gross:	35.0 m
Original Temperature:	28°C
Original Pressure:	10410 kPa
Average Horizontal Permeability:	4.0D
Average Porosity:	25%
Average Water Saturation S_w	25%
Average Oil Saturation S_o	75% pore volume
Oil Viscosity at Reservoir Temp.	1100 mPa.s
Oil Gravity at Reservoir Temp.	979 Kg/m^3
Primary Production Rates:	50.0 m^3/well/day
Source:	Daily Production Reports

Signalta Resources Limited

Pembina - Lobstick

LOCATION
LSD 16 Section: 1 Township: 51 Range: 7 W5M

PARTNERS:
Signalta Resources Limited

PROCESS: Foam-forming surfactant with lean gas injection.
COST: N/A
START-UP: October 1986
TERMINATION: Ongoing

DESCRIPTION

PILOT AREA: 896 ha
WELL PATTERN: 64 ha
WELL SPACING: 64 ha
NO. OF WELLS:

Injection	1
Production	13
Observation	0

FACILITIES

ARTIFICIAL LIFT METHODS: Standard beam pumping unit. Two wells naturally flowing.
TREATER TYPE: Vertical (Installed 1989)
STORAGE FACILITIES: Tankage
TRANSPORT: Trucked to sales.

RESERVOIR

Geological Horizon:	Ostracod
Depth to Top of Formation:	1725 m.KB
Reservoir Thickness:	
net:	1.0 m
gross:	1.0 m
Original Temperature:	57°C
Original Pressure:	15,410 (abs) kPa
Average Horizontal Permeability:	70 md
Average Porosity:	12%
Average Water Saturation S_w	22%
Average Oil Saturation S_o	78% pore volume
Oil Viscosity at Reservoir Temp.	0.35 mPa.s
Oil Gravity at Reservoir Temp.	797 Kg/m^3
Primary Production Rates:	25 m^3/well/day
Source:	Pilot Operator

COMMENTS: Initial reservoir conditions.

Vikor Resources Ltd.

Joffre EOR Pilot - Phase I

LOCATION

LSD ___ Section: 15, 17, 20 & 22 Township: 38 Range: 25 W4M

PARTNERS:

AOSTRA	75%
Vikor Resources Ltd.	14%
Unit Partners	11%

PROCESS: CO_2 Miscible Flood (WAG) and Mobility Control Testing

COST: Capital - $7,500,000

START-UP: December 1982 - First CO_2 Injection January 1984

TERMINATION: 1990

DESCRIPTION

PILOT AREA: 129.5 ha (2 patterns)

WELL PATTERN: Two inverted 5-Spots plus two offsetting water injection wells.

NO. OF WELLS:

Injection	(water) 2
	(CO_2 + water) 2
Production	4
Observation	0

FACILITIES

CO_2 Injection: common with Phase II

ARTIFICIAL LIFT METHODS: Conventional; subsurface pumps.

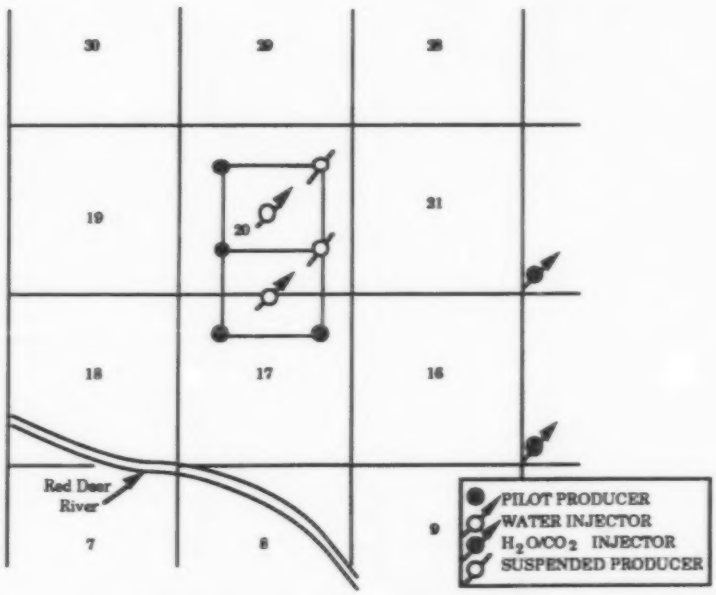
TREATER TYPE: 3-phase test and group separator and 3 phase treater.

STORAGE FACILITIES:

TRANSPORT: Crude sales through (LACT) to Gulf's Pipeline

RESERVOIR

Geological Formation:	Joffre Viking A Sand
Depth to Top of Formation:	1475 m.KB
Reservoir Thickness:	
net:	3 m
gross:	4.5 m
Original Temperature:	56°C
Original Pressure:	7760 kPa
Average Horizontal Permeability:	500 md
Average Porosity:	13%
Initial Water Saturation	30%
Oil Saturation After Waterflood	Appx. 40%
Oil Viscosity at Reservoir Temp.	1-2 mPa.s
Oil Gravity at Reservoir Temp.	813 kg/m^3
Primary Production Rates:	7 m^3/well/day
Source:	AOSTRA



Vikor Resources Ltd.

Joffre EOR Pilot - Phase II

LOCATION
LSD ___ Section: 24,25,26,34 & 35 Township: 38 Range: 26 W4M
LSD ___ Section: 19 & 30 Township: 38 Range: 25 W4M
PARTNERS:

Vikor Resources Ltd.	45%
Unit Partners	35%
AOSTRA	20%

PROCESS: CO_2 Miscible Flood
COST: Capital - $6,500,000
START-UP: July 1985 - First CO_2 Injection July 1985. Expanded in 1988.
TERMINATION: 1995

DESCRIPTION

PILOT AREA: About 450 ha
WELL PATTERN: Two Truncated Inverted 9-Spots
NO. OF WELLS:

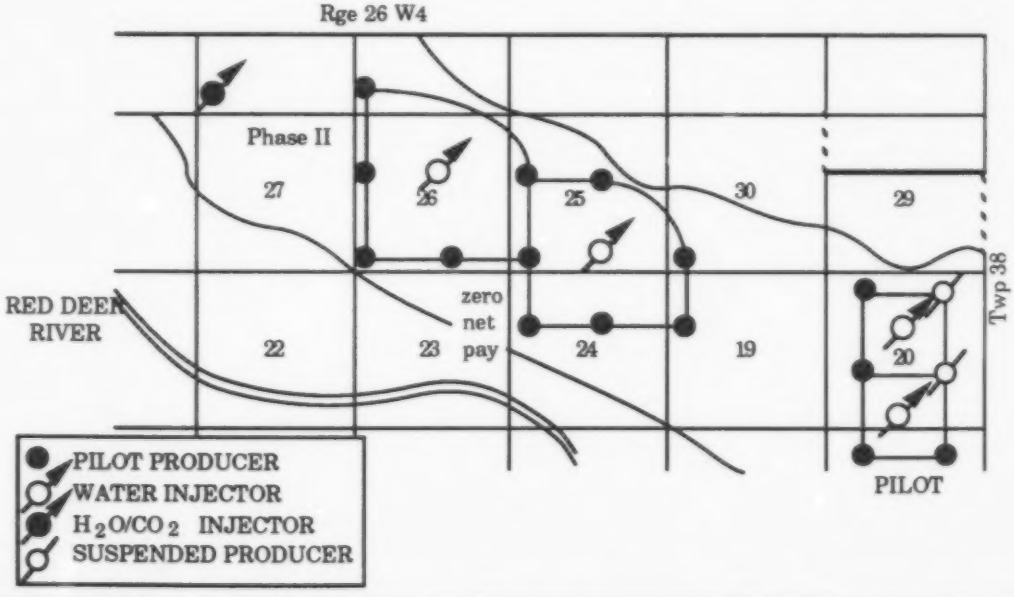
Injection	(water) 1
	(CO_2 + water) 2
Production	11
Observation	0

FACILITIES

Two CO_2 booster compressors - 75,000 m^3/d atmos to 1.0 MPa and injection - 115,000 m^3/d 1.0 to 11 MPa
ARTIFICIAL LIFT METHODS: Conventional subsurface pumps and submersible centrifigal pumps.
TREATER TYPE: 3-phase test and group separators.
STORAGE FACILITIES:
TRANSPORT: Crude sales through (LACT) to Gulf's Pipeline

RESERVOIR

Geological Horizon:	Joffre Viking A Sand
Depth to Top of Formation:	1475 m.KB
Reservoir Thickness:	
net:	3 m
gross:	4.5 m
Original Temperature:	56°C
Original Pressure:	7760 kPa
Average Horizontal Permeability:	500 md
Average Porosity:	13%
Initial Water Saturation	30%
Oil Saturation After Waterflood	Approx. 40%
Oil Viscosity at Reservoir Temp.	1-2 mPa.s
Oil Gravity at Reservoir Temp.	813 Kg/m^3
Primary Production Rates:	7 m^3/well/day
Source:	AOSTRA



Ulster Petroleums Ltd.

Retlaw

LOCATION
LSD ___ Section: 4, 9, 10, 15, 16, 21, 22, 27, 28
Township: 12 Range:18 W4M

PARTNERS:

Ulster Petroleums Ltd.	39.555738%
Atcor Resources Limited	16.356042%
Canada North West Energy	14.636474%
Acanthus Resources Ltd.	1.528604%
Bobby Burns Petroleum (1977) Ltd.	12.175636%
Scurry Rainbow Oil Limited	3.106713%
PanCanadian Petroleum Limited	6.452127%
Oakwood Petroleum Ltd.	1.537419%
Bow Valley Industries Ltd.	1.537419%
Triology Resource Corporation	3.074840%
Plaza Oil & Gas Ltd.	0.038988%

N.B. AOSTRA is a consultive participant in this project.

PROCESS: CO_2 Immiscible Flood and Water Flood

Note: All CO_2 injection wells converted to water injectors. Re-injection of produced solution gas scheduled for Q2 of 1990

COST: N/A
START-UP: 1983
TERMINATION: 1989

DESCRIPTION

PILOT AREA: 1133 ha
WELL PATTERN: Seven irregular patterns.

NO. OF WELLS:

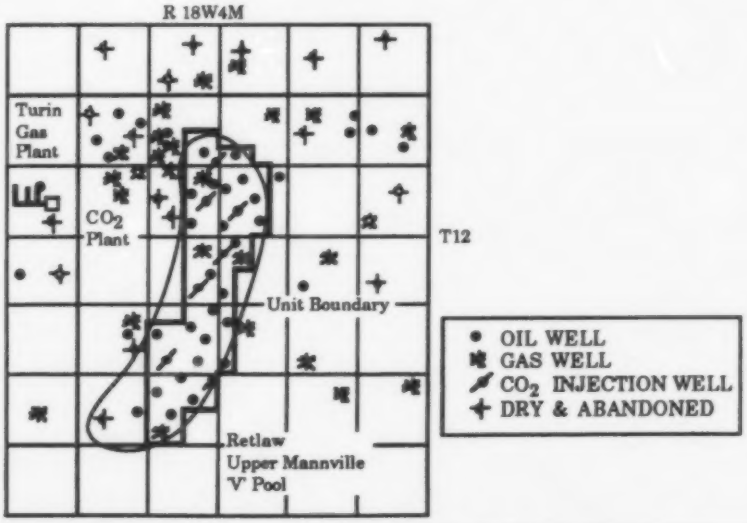
Injection	7
Production	25
Observation	0

FACILITIES

CO_2 compressed and pipeline from external sources.
ARTIFICIAL LIFT METHODS: Standard Pump Jacks
STORAGE FACILITIES: Standard oil battery facility.

RESERVOIR

Geological Horizon:	Retlaw Mannville 'V' Pool (Glauconite Sandstone) Mannville with hydrophilic clays) 'V' Pool
Depth to Top of Formation:	1070 m.KB
Reservoir Thickness:	
net:	2 - 2.5 m
gross:	m
Original Temperature:	35°C
Original Pressure:	11,376 kPa
Average Horizontal Permeability:	50 md
Average Porosity:	18%
Average Water Saturation - S_w	25%
Average Oil Saturation S_o	75% pore volume
Oil Viscosity at Reservoir Temp.	11 mPa.s
Oil Gravity at Reservoir Temp.	916 Kg/m^3
Primary Production Rates:	3-40 m^3/well/day
Source:	Pilot Operator



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